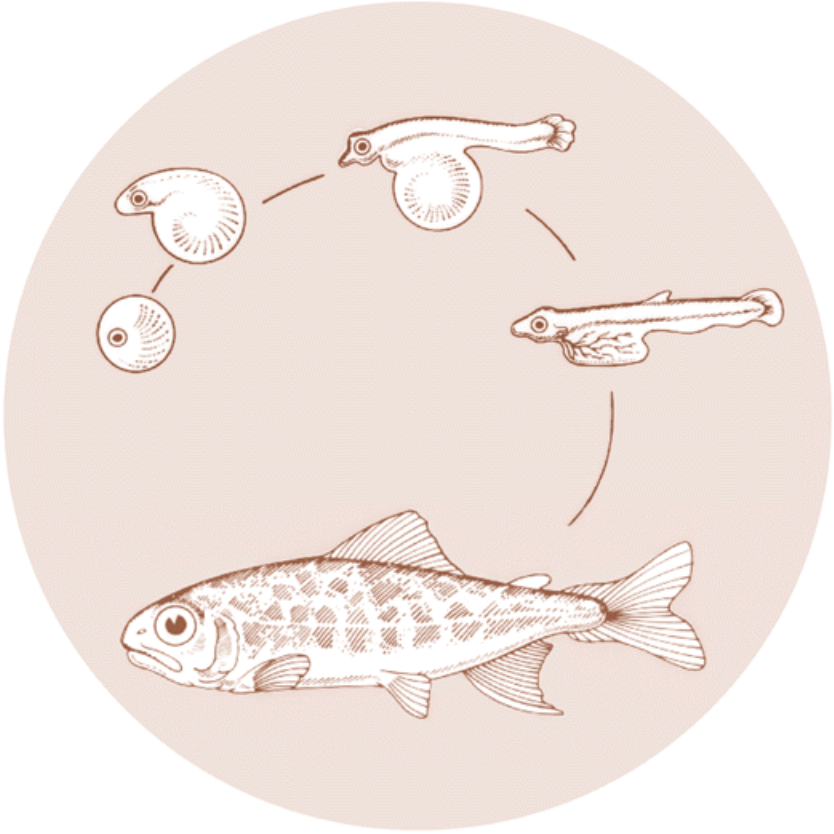
March 1990

MINTHORN SPRINGS CREEK SUMMER JUVENILE RELEASE AND ADULT COLLECTION FACILITY

(Operation, Maintenance and Evaluation of the Bonifer and Minthorn Springs Juvenile Release and Adult Collection Facilities)

Annual Report 1989



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MINTHORN SPRINGS CREEK SUMMER JUVENILE RELEASE AND ADULT COLLECTION FACILITY

(Operation, Maintenance and Evaluation of the Bonifer and Minthorn Springs Juvenile Release and Adult Collection Facilities)

Annual Report 1989

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ABSTRACT

The Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife (ODFW) are cooperating in a joint effort to increase steelhead and re-establish salmon runs in the Umatilla River Basin. As part of this program, Bonifer and Minthorn Acclimation Facilities are operated for holding and spawning adult steelhead and acclimation and release of juvenile salmon and steelhead.

Regularly-scheduled maintenance was completed in 1989. Equipment and pumps received maintenance and repair. An automatic dialing system was incorporated into the alarm system at the Minthorn facility. A security company has replaced the function of the Umatilla Tribal Police which was to contact fisheries personnel in case of an alarm. The configuration of the alarm system was upgraded to activate the alarm faster and provide better access to project personnel with a pager system. A survey was completed in 1988 by Thomas Bumstead of Albrook Hydraulics Lab in Pullman, WA. to determine potential measures to address the change in course of the Umatilla River around Minthorn as a result of the flood of 1986. Options and recommendations were submitted in a report in 1989. Fish Management Consultants Inc. submitted the final reports of evaluations for both the Bonifer and Minthorn facilities.

A total of 150 adult steelhead were collected for broodstock at Threemile Dam from December through March and held at Minthorn. Forty-two pairs were spawned (37 pairs from Minthorn and 5 pairs collected and immediately spawned at Threemile Dam). The 241,682 eggs were transferred to Irrigon Hatchery for incubation and later moved to Oak Springs Hatchery for rearing.

An estimated 368 adult hatchery steelhead returned to the Umatilla River in 1988-89 (based on Threemile Dam trap counts and harvest below Threemile Dam) and 349 were released upriver. Of these, seven returned to the Bonifer trap where the smolts were initially released.

Acclimation of 79,984 spring chinook salmon and 22,274 steelhead was completed at Bonifer in spring of 1989. At Minthorn, 157,299 coho salmon and 29,852 summer steelhead were acclimated and released. Acclimation of 78,825 fall chinook salmon at Minthorn and 80,750 spring chinook salmon at Bonifer was successfully completed in the fall.

Control groups were released instream concurrent with the acclimated releases to evaluate the effects of acclimation on adult returns to the Umatilla River.

Test and control groups were tagged by ODFW for acclimation studies to be performed at the Bonifer and Minthorn facilities in 1989 and 1990. Each group received three separate coded-wire tag

codes. One experiment for fall chinook salmon, two experiments for spring chinook salmon (spring and fall releases) and one experiment for summer steelheadwere tagged.

The progress of outmigration for acclimated releases was monitored at the juvenile salmonid trap located at Westland Diversion. Because the fish in each release were not uniquely identified, fish size and migration timing were used to discern general trends. Data suggested that juvenile salmonids started showing up at the trap 4 days after release until July 14, when sampling was discontinued.

Personnel from the ODFW Eastern Oregon Fish Pathology Laboratory in La Grande took samples of tissues and reproductive fluids to test summer steelhead broodstock from the Umatilla River for monitoring purposes and to certify eggs as pathogen-free.

ACKNOWLEDGEMENTS

This study was funded by Bonneville Power Administration (BPA). The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) thanks Jerry Bauer, Jay Morcotte and other BPA personnel for their assistance. Thanks are extended to Susan Whelan of the Stanfield-Westland Irrigation District and Ray Perkins, Jim Phelps, Ray Hill, Mike Gribble, Warren Groberg, Sam Onjukka and other Oregon Department of Fish and Wildlife (ODFW) personnel for providing assistance in the collection of data at Threemile Dam and spawning of summer steelhead. Dennis Isaac and Bill Murray (ODFW) retrieved and decoded coded-wire tags from adult fish snouts and Bob Becker (ODFW) coordinated fish transports to the acclimation facilities. Thanks are extended to Ray Hill, Dan Barrett, Wayne Stredonsky and Randy Robart (ODFW hatchery managers) for rearing the fish used in the acclimation experiments. We thank the landowners, Rosemary and Wes Gladow, and Richard Kaye for their cooperation and the Union Pacific Railroad for providing access to the acclimation facilities and assisting in fish transfers into the Bonifer facility.

Thanks go to CTUIR staff, whose cooperation and contributions are evident in this report. Doug Olson and Bryson Bronson collected much of the data from adults returning to Threemile Dam and migration data for juvenile salmonids at Westland juvenile salmonid trap. Numerous biologists and technicians assisted in field sampling. Joe Richards provided the administration of the agreement. Julie Burke and Celeste Reves provided secretarial services. Gary James provided technical oversight and critical review of this report and Doug Olson and Keith Kutchins also provided critical review.

Special thanks go to Larry Cowapoo for the long hours and weekends running the facilities and to Larry and Carl Sampson for collecting much of the data included in this report.

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INTRODUCTION

Background

The Umatilla River Basin historically supported large runs of anadromous salmonids, including summer steelhead (Oncorhynchus mykiss), fall and spring chinook salmon (O. tshawytsha) and coho salmon (O. kisutch). The single native anadromous stock left in the basin is a run of approximately 2-3,000 summer steelhead. This steelhead run has been supplemented with fish from Skamania and Idaho (Oxbow) stocks from 1967 through 1970. Fish of Umatilla River stock were used in 1975 and from 1981 to the present (Table 1). The run was 6.7% hatchery (adipose fin-clipped) fish in 1987-88 (the first season that fin-clipped fish were differentiated) and 14.3% in the 1988-89 season. Large runs of chinook and coho salmon were essentially eliminated in the early 1900's. Runs of salmon species have been rebuilt from stocks of various sources (Tables 2, 3 & 4). Forestry, agriculture, irrigation and hydropower are among the developments that have impacted all stocks in the Umatilla River Basin.

A comprehensive plan developed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and the Oregon Department of Fish and Wildlife (ODFW) was implemented to bolster steelhead and re-establish salmon runs in the Umatilla River Basin. Among the initial steps in the plan was construction of two acclimation facilities completed on the Umatilla Indian Reservation. Both facilities were constructed and are operated under the Fish and Wildlife Program of the Northwest Power Planning Council, and funded by Bonneville Power Administration (BPA).

Facility Descriptions and Operations

The Bonifer Pond Facility (Bonifer) is located on the upper Umatilla River **at** rivermile (RM) 2.0 of Meacham Creek. The pond spills into Boston Canyon Creek which flows about 50 yards before entering Meacham Creek. Meacham Creek flows into the Umatilla River at RM 79 (Figures 1 & 2). A water control structure was completed at the outlet of an existing pond and operations began in 1984. The 1.75-acre pond has 4.5 acre-feet of water (Fish Management Consultants, Inc. 1989). It is fed by three springs that originate from l/8 to l/2 mile away. The largest spring parallels the railroad in a series of long pools before emptying into Bonifer. A concrete fishway which can be used as an adult weir, and a parallel underground culvert which was added later, are the two release structures that drain the pond.

The Minthorn Springs Facility (Minthorn) is located about four miles east of Mission, Oregon (Figures 1 & 2). Minthorn Springs Creek is formed from the inflow of several springheads located immediately south of the Umatilla River and east of the facility.

Table 1. Hatchery releases of summer steelhead in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1967	Gnat Creek	109,805	75.0	Skamania
1967	Oak Springs	238,020	117.0	Idaho (Oxbow)
1967	Wallowa	142,240	240.0	Idaho (Oxbow)
1968	Gnat Creek	23,100	66.0	Skamania
1968	Gnat Creek	150,000	Eggs	Skamania
1969	Oak Springs	174,341	145.0	Skamania
1970	Carson	23,400	9.0	Skamania
1970	Carson	16,089	8.0	Skamania
1975	Wizard Falls	11,094	9.0	Umatilla River
1981	Oak Springs	17,600	6-9	Umatilla River
1981	Oak Springs	9,400	145.0	Umatilla River
1982	Oak Springs	59,500	7-8	Umatilla River
1982	Oak Springs	68,000	124.0	Umatilla River
1983	Oak Springs	60,500	11.0	Umatilla River
1983	Oak Springs	52,700	62.0	Umatilla River
1984	Oak Springs	58,000	6.5	Umatilla River
1984	Oak Springs	22,000	135.0	Umatilla River
1985	Oak Springs	53,900	7.0	Umatilla River
1985	Oak Springs	39,100	150.0	Umatilla River
1986	Oak Springs	54,137	8.4	Umatilla River
1987	Oak Springs	1,485	5.5	Umatilla River
1988	Oak Springs	95,290	6.5-10.3	Umatilla River
1988	Oak Springs	10,033	57.5	Umatilla River
1988	Irrigon	24,618	3200.0	Umatilla River
1989	Oak Springs	29,852	6.6	Umatilla River
1989	Oak Springs	29,586	5.6	Umatilla River
1989	Oak Springs	22,274	5.5	Umatilla River

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Table 2. Hatchery releases of fall chinook in the Umatilla River.

Year of Release	Hatchery	NO. Released	No./lb.	Stock
1982	Bonneville	978,336	79.0	Tule
1982	Bonneville	2,559,510	90.0	Tule
1982	Bonneville	290,680	130.0	Tule
1983	Bonneville	100,500	5.9	Upper River Bright
1984	Bonneville	222,580	8.9-9.0	Upper River Bright
1984	Bonneville	636,759	86.0	Upper River Bright
1985	Bonneville	3,221,993	85.0	Upper River Bright
1985	Bonneville	198,145	7.5	Upper River Bright
1985	Bonneville	50,000	16.0	Upper River Bright
1986	Irrigon	90,841	5.0	Upper River Bright
1986	Irrigon	100,000	4.7	Upper River Bright
1986	Irrigon	2,030,OOO	86.0	Upper River Bright
1986	Irrigon	35,574	11.6	Upper River Bright
1987	Irrigon	1,476,830	60.4	Upper River Bright
1987	Bonneville	109,143	8.1	Upper River Bright
1987	Bonneville	102,363	8.0	Upper River Bright
1987	Irrigon	2,000	20.0	Upper River Bright
1988	Irrigon	3,316,007	68.3-93.1	Upper River Bright
1988	Irrigon	14,408	9.8	Upper River Bright
1988	Irrigon	79,681	8.6	Upper River Bright
1988	Bonneville	99,550	10.2	Upper River Bright
1988	Bonneville	100,791	8.8	Upper River Bright
1989	Bonneville	217,443	8.6	Upper River Bright
1989	Irrigon	2,393,710	68.1	Upper River Bright
1989	Irrigon	156,957	10.9-11.1	Upper River Bright

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Table 3. Hatchery releases of spring chinook in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb,	Stock
1986	Carson	99,970	22.8	Carson
1986	Irrigon	300,442	87.0	Carson
1986	Irrigon	75,000	15.0	Carson
1987	Carson	99,897	10.4	Carson
1987	Oxbow	169,100	199.0	Carson
1988	Bonneville	1,196	21.4	Carson
1988	Carson	99,895	20.6	Carson
1988	Bonneville	297,377	8.3-10.3	Carson
1988	Bonneville	75,767	11.1	Carson
1989	Bonneville	160,917	10.6	Carson
1989	Bonneville	164,603	12.0	Carson

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Table 4. Hatchery releases of coho salmon in the Umatilla River.

Year of Release	Hatchery	No. Released	No./lb.	Stock
1966	Little White Salmon	500,000	1312.0	Little White Salmon
1967	Little White Salmon	200,000	1087.0	Little White Salmon
1967	Cascade	500,000	Eggs	Tanner Creek
1968	Little White Salmon	750,000	Eggs	Little White Salmon
1969	Carson	200,040	23.0	Little White Salmon
1987	Cascade	948,549	13.5-14.0	Tanner Creek
1988	Cascade	996,433	16.6	Tanner Creek
1989	Cascade	753,637	17.7	Tanner Creek
1989	Cascade	233,269	17.2-18.2	Tanner Creek

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Figure 1. Umatilla River Basin and Confederated Tribes of the Umatilla Indian Reservation.

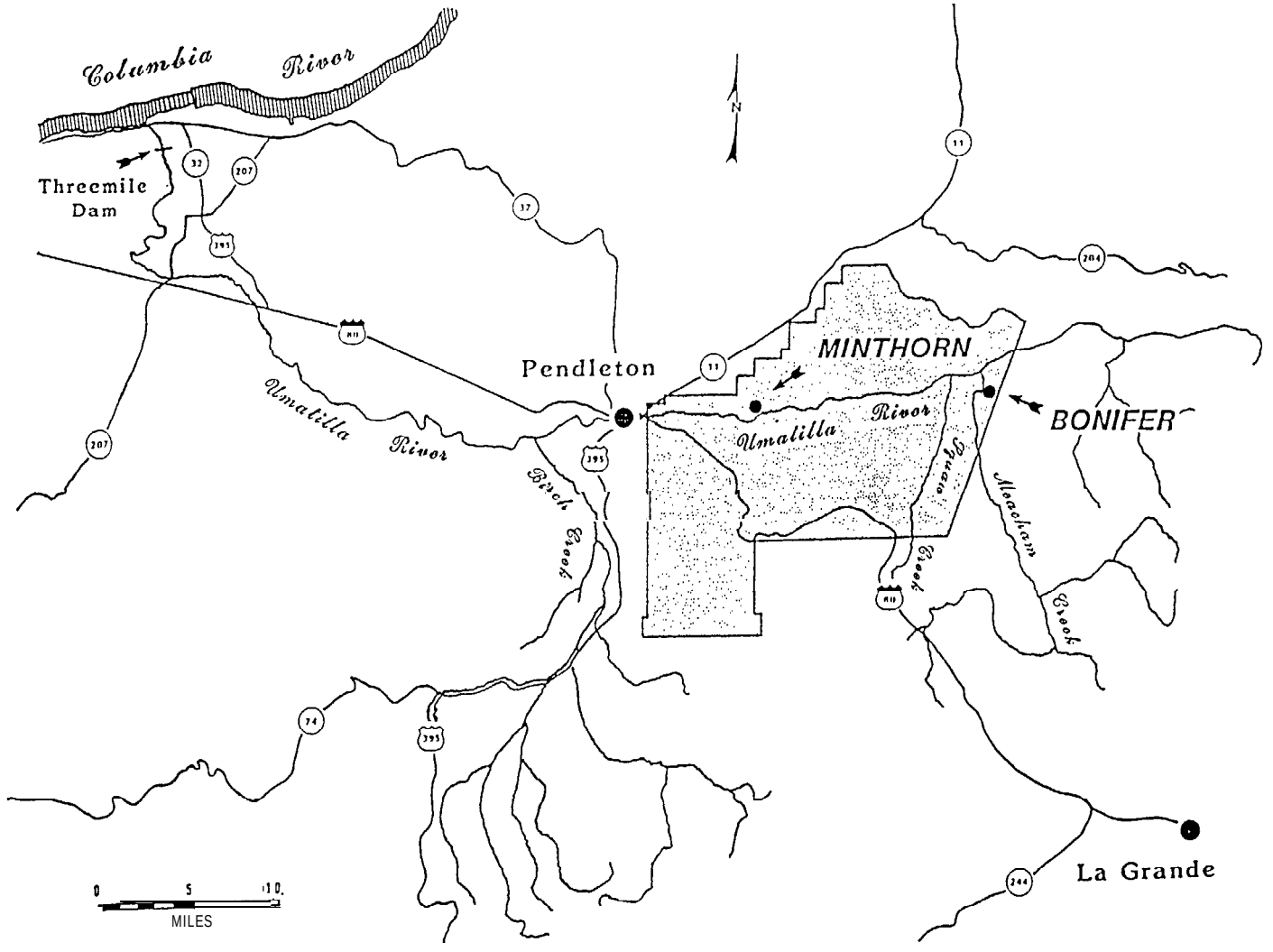

Figure 2. Bonifer and Minthorn Acclimation Facilities and vicinity.

The creek is about one mile long, with the facility located near the mouth at Umatilla RM 63. Minthorn was completed in 1985 and first operated in 1986. Two concrete raceways (120 x 12 feet) were constructed for acclimation of juvenile salmonids. Water is pumped about 40 feet from the creek to the raceways. Water depth is usually held at 3 feet with a single-pass water pumping rate of 800 gallons per minute (gpm) through each raceway. Two valves control the effluent water to allow for either recycling of flows into the intake pond or downstream of the intake and the adult holding area.

The Bonifer and Minthorn Acclimation Facilities (BMAF) are operated by CTUIR with cooperation from ODFW. The facilities have been used for holding and spawning of adult summer steelhead and for acclimation and release of juvenile fall and spring chinook and coho salmon and summer steelhead. The main goals of acclimation are to reduce stress from trucking prior to release and improve imprinting of juvenile salmonids on water from Umatilla River sources to increase returns to the Umatilla River. In addition, an acclimation environment that is conducive to smoltification would be desirable. The proposed Umatilla Hatchery will eventually be the source hatchery for Bonifer and Minthorn, and possibly other satellite facilities slated to acclimate juvenile salmonids. Until that time, fish are being acquired from various sources. This report details activities associated with operation, maintenance and evaluation of the Bonifer and Minthorn Acclimation Facilities in 1989.

Project Objectives

The following specific project objectives for 1989 are part of overall objectives to operate, maintain and evaluate Bonifer and Minthorn Acclimation Facilities:

1. Collect and transport a spectrum of the run of non-adipose fin-clipped adult steelhead returningtothe trap at Threemile Falls Dam (3MD) on the lower Umatilla River.
2. Hold and artificially spawn adult steelhead.
3. Acclimate and release juvenile salmon and steelhead.
4. Monitor general condition and health of adults and juveniles.
5. Maintain, repair and service equipment, buildings and grounds.
6. Place tags in experimental groups of juvenile spring and fall chinook salmon and summer steelhead for acclimation studies.
7. Cooperate and coordinate in data collection at juvenile salmonid traps to determine salmonid species composition and number. Determine migration timing (as related to releases), length frequency and fish condition (by subjective method).
8. Compare length frequency and descaling index of juveniles

during pre-release and outmigration sampling.

9. Obtain flow, temperature and dissolved oxygen data for both acclimation facilities.
10. Collect snouts and data from coded-wire tagged adult salmonids returning to Threemile Dam trap.
11. Access coded-wire tag recovery information from the Pacific States Marine Fisheries Commission and other appropriate sources.
12. Determine the contribution of Umatilla River releases to the ocean, Columbia River and Umatilla River fisheries.

MATERIALS AND METHODS

Collection and Spawning of Summer Steelhead

Adult summer steelhead were collected for broodstock through the cooperative efforts of CTUIR, ODFW and Stanfield-Westland Irrigation District. Fish were collected from the trap at Threemile Falls Dam, located three miles upstream from the mouth of the Umatilla River, during the period December 9, 1988 through May 3, 1989.

Adult steelhead were differentially marked during each time period in which they were collected. Fish were transported to Minthorn using a trailer with a 400-gallon, aerated tank. They were checked for condition weekly and sexual maturation monthly until late March. When the first fish began to ripen, they were checked for maturation weekly. Ripe fish were spawned by Irrigon Hatchery and CTUIR personnel using standard hatchery practices. All fish were sorted for sex and ripeness on the first day of spawning. Thereafter all females were checked weekly for ripeness, and males were handled as necessary to provide pairing for ripe females. Each female was spawned with only one male. Eggs from each pair (family group) were water hardened in iodophor and transported to Irrigon Hatchery to be incubated separately. Eggs from family groups were combined when they were certified as being free from replicating viruses. Eyed eggs free from virus were later transferred to Oak Springs Hatchery for hatching and rearing. The last group of fish spawned were not transported, but were instead collected and spawned at Threemile Falls Dam. Incubation and rearing of steelhead eggs from adults spawned at satellite facilities will eventually occur at the proposed Umatilla Hatchery.

Disease Sampling of Summer Steelhead Broodstock

Spawned adult steelhead were sampled for the presence of selected pathogens by ODFW Northeast Oregon Fish Pathology Laboratory (NOFPL) to certify eggs for transfer from Irrigon Hatchery to Oak Springs for hatching and rearing. Additional sampling as part of the Fish Health Monitoring Program for BPA was also performed on spawned fish and 20 prespawn mortalities.

All 84 spawned fish were sampled for replicating viral agents. The reproductive fluid (ovarian fluid from females or milt from males), pyloric caeca, kidney and spleen were sampled for infectious hematopoietic necrosis virus (IHNV) and infectious pancreatic necrosis virus (IPNV). Kidney smears from 38 spawned pairs were sampled for bacterial kidney disease (BKD) and 60 blood samples were taken to examine for erythrocytic inclusion body syndrome (EIBS). Samples of head cartilage from 60 fish were taken to test for the presence of Myxosoma cerebralis (whirling disease) in the population.

Twenty steelhead that died during holding were individually sampled. Kidney smears were taken for BKD and samples of the lower intestine were examined for Ceratomyxa Shasta. Cultures from the kidney were also taken to test for typical bacterial pathogens.

All samples were analyzed at NOFPL by Warren Groberg and Sam Onjukka except tests for whirling disease that were performed at the ODFW Fish Pathology Laboratory at Corvallis by Harriet Lorz.

Adult returns to Bonifer

Seven adult summer steelhead were captured at Bonifer while the fish trap was in operation from January 12 through the end of May.

Acclimation and Release of Juvenile Salmonids

Juvenile salmonids were transported by ODFW from hatcheries using 2,000 to 5,000 gallon tankers. Transfers were completed in one to three days. Juveniles were fed 3mm Biomoist Feed% twice a dayI in the morning and the afternoon.

Mortalities were removed daily at both facilities. ODFW pathology personnel were available for specific disease problems should they become apparent in mortalities or live fish.

Transfer mortality (immediate and delayed mortality) was defined as all fish that die within 5 days of the last transfer date. Total number of fish at release is estimated using ODFW hatchery records, ODFW transfer and release reports, acclimation mortality records and ODFW tagging records. Number of fish reported as tagged at release is estimated using sampling for tag retention just prior to release and information on the total number of fish. Clipped fish are those with an adipose fin clip for salmon and a left pelvic fin clip plus an adipose fin clip for steelhead. Fish reported as tagged have the correct fin clips for the species and a coded-wire tag.

Samples for length frequency data were taken using standard ODFW techniques. The descaling index was completed in general accordance with the techniques of Scully et al. (1984). For the criteria of severe descaling, ten potential descaled areas were identified, five from each side of the fish. These scaled sections **are** above a line extending from the vent to the insertion of the pectoral fin. Severe descaling is defined as loss of greater than 40% of the scales in at least 2 of these ten sections. Partial descaling addresses loss in scaled areas on the right and left sides of the fish. Partial descaling was defined as loss of greater than 3% of the scales on at least one side of the fish.

Smolt index criteria were obtained from ODFW (personal communication with Rich Carmichael). The criteria used for smolts

were deciduous scales and silvery bodies with no visible parr marks. The criteria for intermediates were light colored bodies with visible parr marks and the criteria for parr were dark bodies with highly visible parr marks.

Temperatures reported associated with specific acclimation periods are data from hourly readings that correspond to the date of first transfer to the last date of release unless otherwise indicated. Complete temperature data are not available for portions of some acclimation periods. All available data are reported.

Percent body weight of food fed was determined with poundage transferred (ODFW Transfer Reports) and theoretical weight gains based on conversion efficiencies determined by water temperatures.

Outmigration Monitoring

Juvenile salmonids were collected in the trapping facility (smolt trap) at Westland Diversion (RM 27), about 36 and 54 rivermiles downstream from Minthorn and Bonifer, respectively. This was the only place that a concerted effort was made to monitor the outmigration of juvenile salmonids downstream from the release sites in 1989. The trap was set on April 4 and operated until July 14.

Fork length, species and mark were recorded on an enumerated subsample of fish. The total number of fish in the trap was estimated by counting the number of fish in a "net" and estimating the number of fish in each net thereafter. The fish in every fifth or sixth net were actually counted to adjust the estimated number of fish in each scoop because a decreasing number of fish were being removed from the trap as the number in the trap decreased. Fish trailers being used in 1990 will have volume indicators to assist in estimation of the number of fish in the trailer. Descaling and smoltification indices were recorded on a sample of fish weekly.

The trapping facility is small and crowding stresses the fish. A new smolt trap facility is being built and is scheduled for completion in 1990 as a part of the new Westland screen system.

Assessment of Acclimation Facilities

As part of the Northwest Power Planning Councilts Fish and Wildlife Program, the Umatilla Hatchery will provide increased juvenile salmonid production for the Umatilla River Basin. This increase may require additional acclimation facilities. Capacities of existing facilities must be determined however, before this decision can be made.

In 1989, Fish Management Consultants contracted with CTUIR to address the adult and juvenile carrying capacities of Minthorn Acclimation Faciltiy and to review and recommend improvement to achieve the operational goals as outlined in the N.E. Oregon Master Plan (NOMP 1989).

Automatic temperature recorders (Ryan Tempmentors") recorded hourly temperatures at both facilities in 1989. One was installed at Bonifer outlet and the other at the pump intake at Minthorn. Operational data (taken during acclimation) were taken early in the morning. This included dissolved oxygen (DO) and temperature at the facility. Additional **DO** and temperature data **at** adjacent and upstream areas of the springheads were also recorded starting on 5/6 to provide a profile of the water source for both Minthorn and the largest spring at Bonifer. Operational data were recorded daily when juveniles were being held. During non-acclimation periods, data were recorded weekly. In early October, the time at which the data were taken was changed to one hour before sunrise to reflect the approximate low DO for the night.

Acclimation Research

The first steps toward setting up a research program to evaluate the potential benefits of acclimation were initiated in 1987 by coded-wire tagging different groups of fish. In 1989 juvenile salmonids were tagged and marked by ODFW under subcontract for both 1989 and 1990 releases. Tagging data included in this report were compiled from ODFW Coded Wire Tagging Operation Summaries. Three replicate tag codes were used for each test (acclimated) and control (non-acclimated) group. Chinook salmon were coded-wire tagged (CWT) and given an adipose fin clip. Summer steelhead were CWT and had both the adipose and left pelvic fin clipped.

Adult Survival

Adult salmonids marked to indicate the presence of coded-wire tags were collected at the trap at Threemile Falls Dam and from spawning ground surveys. The snouts were removed and associated data for each snout were recorded. Snouts and data were sent to **ODFW in Clackamas, OR. for tag removal and decoding.**

Data available from Pacific States Marine Fisheries **Commission, Washington Department of Fisheries and ODFW were** accessed to compile adult survival and return information for all past releases of coded-wire tagged fish released in the Umatilla River.

RESULTS AND DISCUSSION

Facility Maintenance

Repair and maintenance were completed at Minthorn in 1989. The alarm configuration was changed to provide faster response to problems at the facility. An automatic dialer was installed to communicate with Moon Security Service of Pasco, WA. which was responsible for contacting fisheries personnel. The Umatilla Tribal Police Department had previously performed this service. Pagers were used again this year to provide continuous access to personnel and quick response time to any problems at Minthorn. Problems with electrical power shutdown and flooding in the adult holding area provided most of the problems that triggered an alarm. Weed abatement constituted much of the normally-scheduled maintenance. All electrical and pumping equipment were checked, and serviced as necessary, before each acclimation period. Grates and screens at the pump intake and the head and outlet of the raceways were cleaned daily, or more often as required while fish were being held. The intake and adult holding areas were cleaned as necessary.

An hydrologist, Thomas Bumstead of Albrook Hydraulics Lab in Pullman, WA., was hired to provide a report detailing options and recommendations to improve fish passage for entry and exit from Minthorn caused by the change in streamcourse of Umatilla River in 1986 (Bumstead 1989). The report submitted details of the following options:

1. Leave the site as is and continue to operate the facility with the existing juvenile and adult passage problems.
2. Leave the site as is with no major structural or channel changes, and initiate an annual maintenance program for juvenile passage and, if desirable, adult attraction and passage.
3. Leave Umatilla River in new channel and divert part of the flow into a modified channel which passes by the Minthorn Springs fishway, to enhance juvenile and adult passage.
4. Move Umatilla River from new channel back into old channel to enhance juvenile and adult passage.

The second option was recommended based on preliminary cost estimates. While this option would commit CTUIR to a long-term maintenance program, the lower cost favors this alternative over the others.

Routine maintenance work at Bonifer consisted mostly of weed abatement in the work area around the outlet and maintenance of the electric fence. The cobble barrier at the inlet of Bonifer Springs Creek was rebuilt before the first group of fish was transferred to the facility. An attempt was made to clear away some of the aquatic vegetation that had grown during the summer previous to the

start of the fall acclimation. Although much of the plant material was removed, the venture was labor-intensive. Removal of rooted aquatic vegetation would have to be done monthly or more often throughout the growing seasonto keep the vegetation "trimmed back" for the fall acclimation. After the fall acclimation, weir structures were placed at each of the springs to provide a method to measure flow. Additional configurations at the structure for the largest spring allows placement of a barrier to prevent migration into the springheads. Various barriers will be tried in the spring of 1990.

Collection and Spawning of Adult Summer Steelhead

A total of 150 adult steelhead were captured at Threemile Dam and transported to Minthorn during the 1988-89 trapping season (Table 5). Fish were collected from December through March and held through April. Only 54 steelhead passed the trap in February, so "February" fish were collected in early March. The 1988-89 run dropped off significantly in February compared to the previous 16-year average (Figure 3). Fish collected in April were not transported, but were spawned at Threemile Falls Dam.

Prespawning mortality of transported fish during the adult holding period was 20% (Appendix A). This was about the same as the more recent years at Bonifer (24% 1987; 22% 1986; 10% 1985; and 8% 1984), and much less than at Minthorn in 1988 (39%). A total of 30 adults died prior to completion of spawning in mid-April. Prespawn mortality was about the same in males and females (22% and 18%, respectively) compared to last year when it was much higher in females (53%) than in males (26%). As in previous years, mortality was low (zero in 1989) until after the first spawning, after which it increased (Appendix A). Low mortality this year may have been due to fish becoming ripe earlier, and the egg quota being met by the middle of April. A shorter holding and spawning period and less handling may have caused fewer losses. A larger percentage of the females collected in December and January (59% and 64%, respectively) were spawned than those collected in early and late March (32% and 27%, respectively) (Table 6).

The goal is to spawn a cross-section of the run. However, because the females collected in December and January matured first, a higher percentage of these fish were spawned until the egg quota was met. In the future, an effort should be made to spawn a proportionate number of the later returning fish. Perhaps a higher percentage of the total fish collected should come from the latter part of the run. This may help to insure that the majority of the eggs are not taken from early fish.

Thirty-seven females from Minthorn were spawned along with five females collected at Threemile Falls Dam. A total of 241,682 eggs were taken with an average fecundity of 5,754 eggs per female

Table 5. Collection and transport of steelhead broodstock - 1988-89. 1/

Date	Males	Females	Total	Mark
December 9	13	17	30	upper left opercle punch
January 19	18	22	40	lower left opercle punch
March 3	10 2/	5 2/	15	upper right opercle punch
March 10	8 2/	17 2/	25	upper right opercle punch
March 27	18	22	40	lower right opercle punch
TOTALS	67	83	150	

Revised: 06-06-90 A:\123R2\DATA\STCOL89A

1/ All adults trapped at Threemile Dam.
No adipose fin-clipped fish were taken.
All fish that were transported were held at Minthorn.

2/ "February" fish were taken in early March.

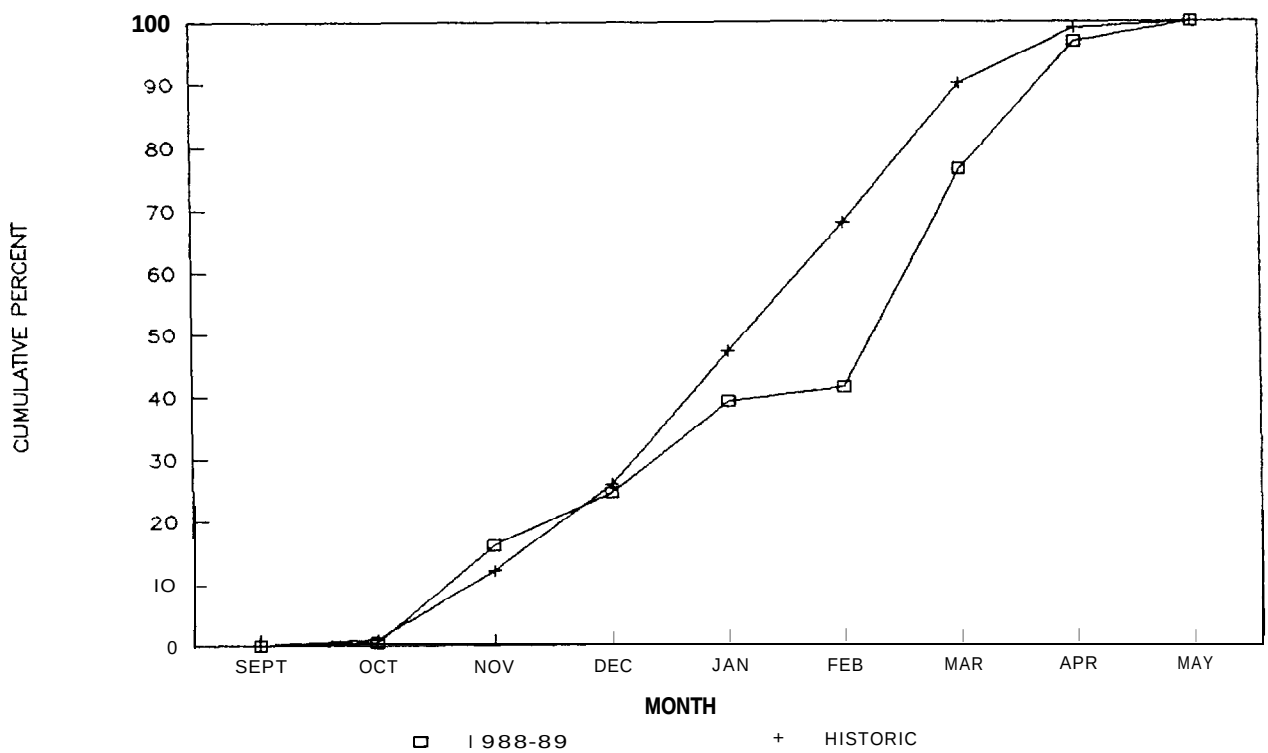

Figure 3. Historic versus 1988-89 run of summer steelhead in the Umatilla River.

Table 6, Date of spawnig for summer steelhead versus date of collection in 1989,

Date spawned	Males Date Collected 12-9	I-19	3-3&10	3-27	Total	Females Date Collected 12-9	l-19	3-3&10	3-27	Total
4-5	1	7	5	3	16	6	8	2	0	16
4-12	1	1	1	2	5	0	1	1	3	5
4-21	4	5	4	3	16	4	5	4	3	16
Total	6	13	10	6	37	10	14	7	6	37
Females collected						17	22	22	22	03
Females X spawn						59	64	32	21	45

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(Appendix A). The eggs from six family groups were discarded because the results of IHNV and IPNV tests produced positive or inconclusive results and the eggs could not be cleared as disease free.

Disease Sampling of Summer Steelhead Broodstock

The presence of two fish pathogens was detected in the spawned fish. The pooled cartilage sample produced a presumptive positive result for M. cerebralis. Spores in the typical size range were noted. Positive identification could not be confirmed in the five cartilage sections sampled (Table 7). Of the 84 individuals tested for replicating viruses, three tests for IHNV were positive and family groups 40, 41 and 42 were destroyed. Initial tests for family groups 27, 33 and 39 were inconclusive, and additional subcultures were performed. By the time the eyed eggs were to be transported to Oak Springs Hatchery the results from the subcultures were not available. All eggs that tested negative were shipped and eggs that had questionable results were destroyed. Subculture revealed that the latter family groups were clean, hence the incidence was reported as 3 of 84 fish (Table 7).

The only fish pathogens detected in mortalities were spores of & Shasta in 7 of 20 fish and aeromonad-pseudomonad bacteria in 13 of these same 20 fish. The aeromonad/pseudomonad bacteria were not at levels considered lethal (Table 7).

Adult returns to Bonifer

In 1988-89, an estimated 368 adult hatchery steelhead returned to the Umatilla River (based on Threemile Dam trap counts and harvest below Threemile Dam) and 349 were released upriver. Of these, seven were captured in the Bonifer trap where the smolts were initially released. In 1987-88, an estimated 185 hatchery fish returned to the Umatilla River and 160 were released upriver. Of these, two were captured at Bonifer. Nine steelhead redds were found in the lower one mile of Boston Canyon Creek in 1989, while two were observed in 1988. Most returns destined for Bonifer most likely spawned in Meacham Creek.

Acclimation and Release of Juvenile Salmonids

Six groups of acclimated juvenile salmonids (448,984 fish) were among the 4,162,248 salmon and steelhead released into the Umatilla River in 1989 (Table 8). Tagged groups of yearling fall chinook salmon were not available for spring acclimation at Minthorn in 1989, but coho salmon were available. Three tag codes in three separate raceways at Cascade Hatchery were to be released in the Umatilla River. One tag code went into each raceway at Minthorn, with the third being used as the control group. One group of untagged steelhead was also acclimated at Bonifer in the spring. All other acclimated groups were tagged with funding from BPA and are part of the formal facility evaluations. Three tag codes for each test (acclimated) and control group (unacclimated -

Table 7. Results of disease sampling of summer steelhead spawned and prespawn mortality in 1989 for Umatilla River broodstock. /1

Group	Test	Incidence	Comments
Spawned	IHNV	3184	eggs were destroyed
	IPNV	O/84	
	EIBS	O/60	
	BKD	O/38	pairs sampled
	Whirling disease	presumptive positive	pooled 60 fish sample (Spores typical in the size range of M. cerebralis, but could not be confirmed in 5 cartilage sections sampled)
Morts	Ceratomyxa Shasta	7/20	
	Aeromonas/ Pseudomonas	13/20	not at levels considered lethal for fish
	BKD	7/20	

Revised: 11/12/90 Filename : A:\123R2\DATA\DISES89A

/1 Data provided by ODFW Fish Pahology Laboratories in La Grande and Corvallis.

Table 8. Juvenile salmon and steelhead released in the Umatilla River Basin - 1989,

	Species	Brood	Stock	Hatchery	Nunber	#/lb.	Location	In facility	In river	Fish mark	Nunber marked
	Fall chin.	87	Bonneville	Bonneville	217,443	8.6	Una RH 65-12	--------.	Mar l-3	NO	
	Fall chin.	88	Priest Rapids	Irrigon	2,393,710	68.1	Una Rm 22	---------	May 15-17	CWT	154,243
(#)	fall chin.	88	Priest Rapids	Irrigon	78,825	IO,9	Minthorn	Sep 27	Oct 18	CWT	76,824
(#)	fall chin.	88	Priest Rapids	Irrigon	78,132	11.1	Nr. Minthorn	---------	Oct 18	CWT	76,425
	Total				2,768,110						
(#)	Spring chin,	87	Carson (C/L)	Bonneville	79,984	10.6	Bonifer	Mar 7-8	Mar IO-May 23	CWT	77,817
(*)	Spring chin,	87	Carson (C/L)	Bonneville	80,933	IO,6	Nr, Bonifer	---------	Mar 27-28	CWT	79,300
(#)	Spring chin.	88	Carson (C/L)	Bonneville	80,130	12.0	Bonifer	Oct 10	Oct 13	CWT	80,209
(#)	Spring chin,	88	Carson (C/L)	Bonneville	83,853	12.0	Hr. Bonifer	---------	Oct 13	CWT	83,392
	Total(+)				323,320						
	Barly coho	87	Tanner Creek	Cascsde	153,631	17.7	Una RM 55-70	---------	Mar 14-22	NO	
(+)	Barly coho	87	Tanner Creek	Cascade	131,299	18,2	Minthorn	Mar 7-9	Mar 31	CWT	53,115
(#)	Barly coho	87	Tanner Creek	Cascade	75,970	17.2	Hr. Minthorn		Mar 31	CWT	27,062
					986,906						
(+)	Sun stld,	88	Umatilla	Oak Springs	29,852	6.6	Minthorn	April 4-5	May 17-18	CWT+LV	26,357
(+)	Sun stld.	88	Umatilla	Oak Springs	29,586	5.6	Hr. Minthorn	---------	May 17-18	CWT+LV	26,369
	Sun. stld,	88	Umatilla	Oak Springs	22,274	5.5	Bonifer	April 4-5	Apr 4-May 23	AD only	
	Total				81,712						

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(#) Acclination evaluation (unacclimated control group released instreas near facilities at time of acclimated release], (C/L) Carson via Lookingglrss stock,

(+) Spring chinook from Carson llatchery were not liberated in the Umatilla River due to disease problems.

kept at the hatchery until release) were tagged.

Fall chinook salmon have been released in the Umatilla River every year since 1982 and from acclimation facilities since 1983 (Table 9). In 1982, this release was of Tule stock. Since then all releases have been of upriver bright stock (Table 2). This is the fourth year that spring chinook salmon of Carson-via-Lookingglass stock have been acclimated and released (Table 3). Summer steelhead of Skamania and Oxbow stocks were released from 1967 through 1970. In 1975, one release of Umatilla stock steelhead occurred and fish releases every year since 1981 have been from this stock (Table 1). Coho salmon have been released since 1987, and a portion have been acclimated when the facilities and the fish were available (Table 4 & 10).

Acclimation at Minthorn

Coho salmon - 3/7 to 3/31

The first lot of fish held at Minthorn in 1989 was coho salmon (1987 brood) that were reared at Cascade Hatchery (Table 8). ODFW transferred fish into the facility on 3/7-9. Individual tag codes held at the hatchery in different raceways were transferred to different raceways at Minthorn. Tag code 074610 went into the upper raceway, while tag code 074611 went into the lower raceway. Transfer mortality was 81 in the upper raceway and 73 in the lower raceway. Total mortality was 206 and 196 respectively.

Temperature ranged from 4.9 to 10.5 and averaged 7.5 degrees C (Appendix B). Daily dissolved oxygen readings ranged from 7.0 to 10.8 ppm (Appendix C). Fish in each raceway were fed 0.55% body weight of food per day until release on 3/31. The average size at release for both raceways was 18.2/lb.

Of the 72,627 fish released with tag code 074610, 26,416 were tagged. Of the 84,672 fish released with tag code 074611, 26,739 were tagged. A control group of 75,970 fish, with 27,062 being tagged, was released at 17.2/lb. at the same time as the acclimated fish (Table 11). Length frequencies of marked and unmarked fish were similar for all three tagcodes. No difference was observed in the length frequencies of marked fish for each tag code (Figure 4). None of the acclimated or control fish (marked and unmarked) were considered to have either partial or severe descaling (Appendix D). A higher percentage of the test fish were reported as being smolts and intermediates than the control group (80% versus 10% respectively) (Appendix D).

Summer steelhead - 4/4 to 5/18

The second lot of fish acclimated at Minthorn were 1988 brood summer steelhead from adults spawned at Minthorn, transferred to

Table 9. Juvenile fall and spring chinook salmon releases in the Umatilla River Basin (1981-1989). 111

Species	Fall Chinook				Spring Chinook		
Area	Louer Umatilla	Upper Umatilla	Bonifer	Minthorn	Lower Umatilla	Upper Umatilla	Bonifer
Year							
1982	3,828,526 (syIC21	0	0	0	0	0	0
1983	0	80,500 (Y)	20,000 (Y)	0	0	0	0
1984	636,759 (SY)[31	169,280 (Y)	53,300 (Y)	0	0	0	0
1985	3,221,993 (sy)C31	60,490 (Y)	137,655 (Y) 50,000 (sy)[4]	0	0	0	0
1986	2,030,000 (sy)[3]	0	100,000 (Y)	90,841 (Y) 35,574 (sy)[4]	0	300,442 (SY)	99,970 (Y) 75,000 (sy)[4]
1987	1,476,830 (sy)[5]	0	102,363 (Y)	111,143 (y)[6]	0	169,100 (SY)	99,897 (Y)
1988	3,316,007 (sy)[5&7]	79,681 (Y)	99,550 (Y)	115,199 (y)	156,312 WC71	210,496 (Y)	107,427 (Y)
1989	2,393,710 (sy)	295,575 (Y)	0	78,825 (Y)	0	164,786 (Y)	160,734 (Y)

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111 y = yearling releases; sy = subyearling releases

[2] Releases in 1982 were Tule stock; all others have been upriver brights.

[3] Subyearlings released below Threemile Dam to avoid loss in irrigation diversions.

[4] Subyearlings acclimated in summer and released as yearlings in fall.

[5] Released at Steelhead Park near Hermiston.

[6] 2,000 of these are an estimated number from an emergency release.

[7] Released below Uestland Dam.

Table 10. Juvenile steelhead and coho salmon releases in the Umatilla River Basin (1981-1989) [1].

Species	Summer Steelhead				Coho		
Area	Lower Umatilla	Upper Umatilla	Minthorn	Bonifer	Lower Umatilla	Upper Umatilla	Minthorn
Year							
1981	0	17,558 (Y) 9,400 (SY)	0	0	0	0	0
1982	0	59,494 (Y) 67,940 (sy)	0	0	0	0	0
1983	0	60,500 (Y) 52,700 (SY)	0	0	0	0	0
1984	0	0	0	57,939 (Y) 22,000 (sy)	0	0	0
1985	0	0	0	53,850 (Y) 39,134 (SY)	0	0	0
1986	0	0	0	54,137 (Y)	0	0	0
1987	0	1,485 (y) [2]	0	0	786,660 (y)[3]	0	161,889 (Y)
1988	33,984 (y) 131	40,790 (y) [4&5]	30,549 (Y)	0	996,433 (y)[3]	0	0
1989	0	29,586 (Y)	29,852 (Y)	22,274 (Y)	0	829,607 (Y)	157,299 (Y)

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[1] y = yearling releases; sy = subyearling releases

[2] Small release due to IHN & IPN problems in eggs.

[3] Fish released below Westland Dam.

[4] Includes both experimental control group and gradeouts from 88 brood year.

[5] Does not include any unfed fry that were released.

Table 11. Liberation information for all coho salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
85	37,245	April 87	13.5	13,440	073617	Minthorn
85	53,754	April 87	13.5	19,879	073624	Minthorn
85	70,890	April 87	13.5	26,740	073625	Minthorn
	161,889			60,059[a]		
86	68,208	March 88	16.8	20,592	074356	L Uma R
86	73,650	March 88	17.3	19,038	074357	L Uma R
86	61,606	March 88	15.7	18,588	074358	L Uma R
	203,464			58,218		
87	75,970	March 89	17.2	27,062	074609	Nr Minthorn
87	72,627	March 89	17.3	26,416	074610	Minthorn
87	84,672	March 89	19.1	26,739	074611	Minthorn
	233,269			80,217		

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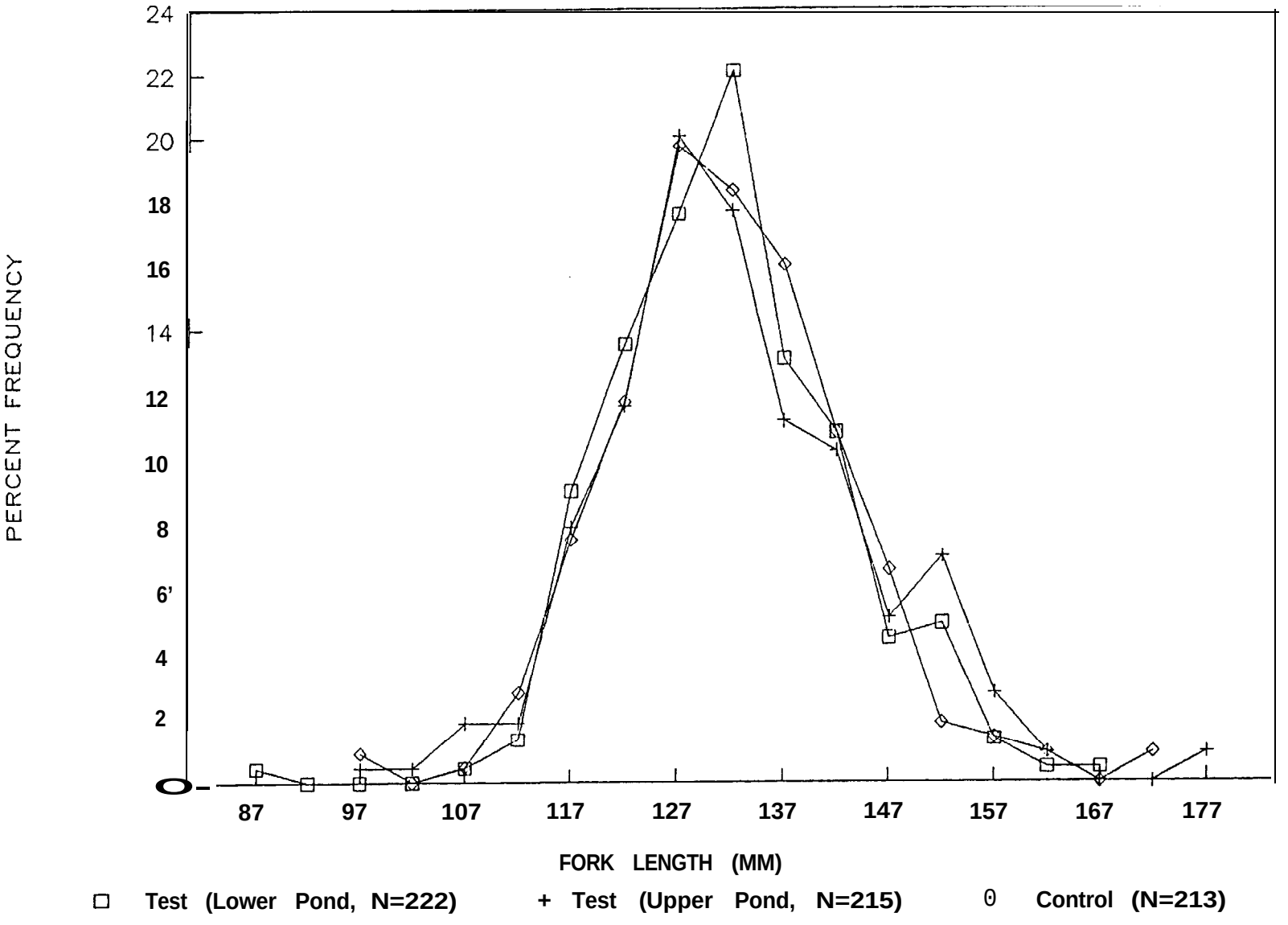

Figure 4. Length frequencies of experimental groups of coho salmon released at Minthorn Acclimation Facility on 3-31-89 - test (lower and upper ponds) versus control qroup.

Irrigon Hatchery for incubation, and shipped as eyed eggs to Oak Springs Hatchery for hatching and rearing (Table 8). Fish were transferred to the lower raceway on 4/4-5. Transfer mortality was 138 while overall mortality was 273. This was the second year that summer steelhead have been tagged and released into the Umatilla River (Table 12), although hatchery fish have been released since 1967. The fish are being tagged as part of a program to evaluate whether acclimating the fish prior to release will increase adult survival to the Umatilla River.

During acclimation, temperatures ranged from 5.8 to 14.8 with an average of 10.2 degrees C (Appendix B). Dissolved oxygen ranged from 7.0 to 9.8 ppm (Appendix C). Fish were fed 1.21% body weight of food per day until their release at 6.6/lb. on 5/17-18. We were able to hold fish longer (to release them at a larger size) than last year because flows did not drop as early in the season as in 1988. Of the 29,852 fish released, 26,357 were tagged (three tag codes). A control group of 29,586 with 26,369 being tagged (three tag codes), was released at 5.6/lb concurrent with the acclimation group (Tables 8 & 12). The difference in release size of the acclimated amd non-acclimated groups is a problem which needs to be addressed. Better coordination is needed between CTUIR and ODFW hatchery personnel to insure that both groups are the same size at release.

Length frequencies for marked and unmarked fish were not differentiated because the group was supposed to be 100% marked and there were few unmarked fish. Length frequencies for acclimated and non-acclimated fish are shown in Figure 5. None of the acclimated or control fish were considered to have severe descaling, while the amount of partial descaling for acclimated and control fish was 3% and 4% respectively (Appendix D). The smolt indices for test and control fish were similar (Appendix D).

Fall chinook salmon - 9/27 to lo/18

The final transfer of fish into Minthorn was 1988 brood fall chinook salmon reared at Irrigon Hatchery (Table 8). Fish were tagged with three different tag codes and were not segregated by raceway (Table 13).

Spring inflow into the intake pond was low. Operating procedures at Minthorn were changed to recirculate water to continue to provide 800 gpm to each raceway as was done for the first time in 1988.

Weekly dissolved oxygen readings (DO) as low as 6.1 ppm were recorded at the pump intake in late July through early September. Additional DO readings at the site of the proposed intake structure were also low (5.9 ppm). Overnight readings every two hours on 8/31-9/l suggested, as does much literature on DO fluctuations

Table 12. Liberation information for all summer steelhead coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
87	10,187	Apr 88	7.4	9,829	073859	Minthorn
87	10,075	Apr 88	7.4	9,721	073860	Minthorn
87	10,287	Apr 88	7.4	9,925	073861	Minthorn
	30,549			29,475		
87	10,423	Apr 88	6.5	9,689	073856	Nr.Minthorn
87	10,171	Apr 88	6.5	9,455	073857	Nr.Minthorn
87	10,163	Apr 88	6.5	9,448	073858	Nr.Minthorn
	30,757			28,592		
88	9,949	Apr. 89	6.6	8,784	074720	Minthorn
88	9) 954	Apr 89	6.6	8,789	074723	Minthorn
88	9,949	Apr 89	6.6	8,784	074724	Minthorn
	29,852			26,357		
88	9,873	Apr 89	5.6	8,800	074715	Nr.Minthorn
88	9,864	Apr 89	5.6	8,791	074717	Nr.Minthorn
88	9,849	Apr 89	5.6	8,778	074718	Nr.Minthorn
	29,586			26,369		

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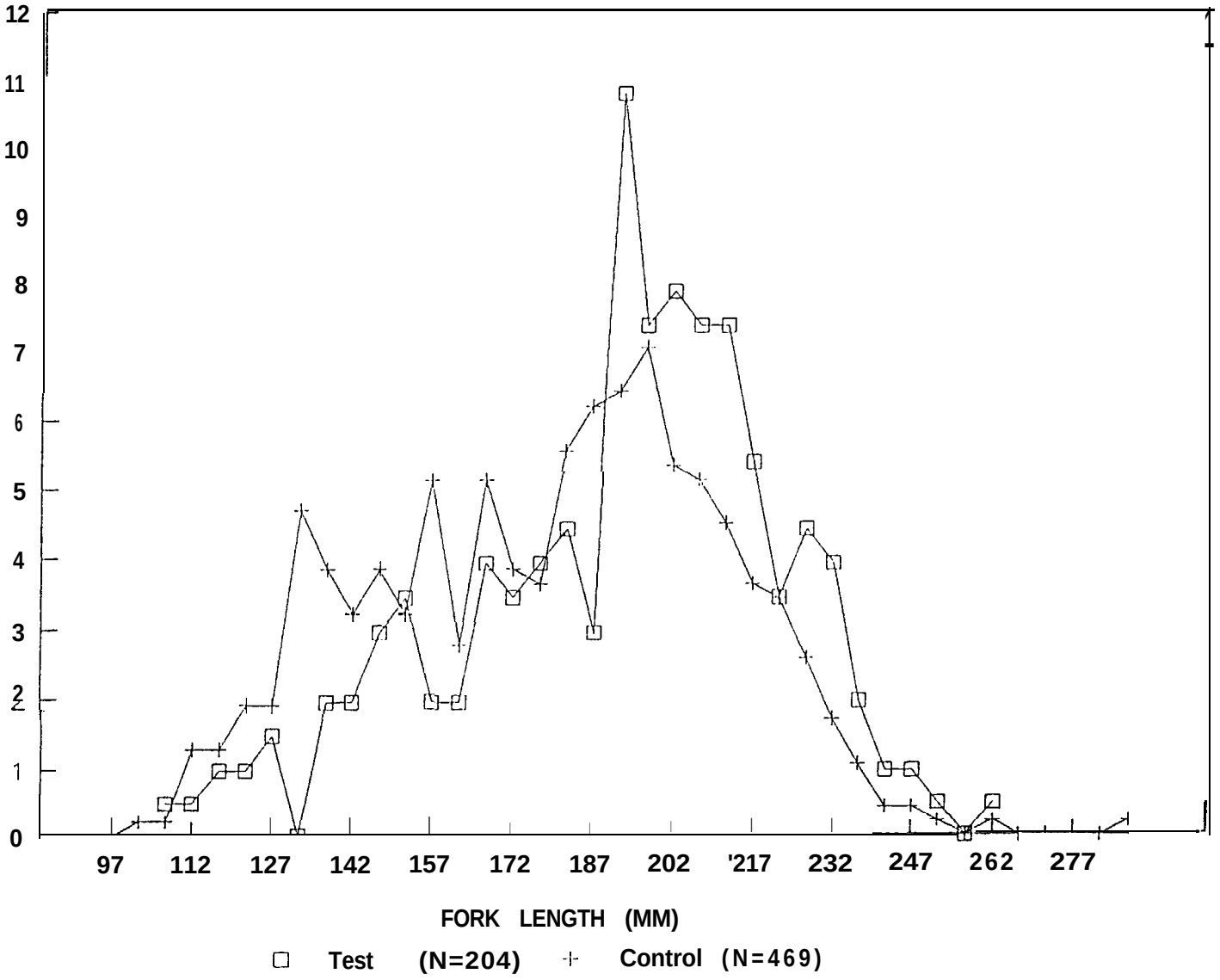

Figure 5. Length frequencies of experimental groups of summer steelhead released at Minthorn Acclimation Facility on 5-18-89 - test versus control group.

Table 13. Liberation information for fall chinook salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
86	52,317	Mar 88	8.8	42,068	074038	Minthorn
86	48,474	Mar 88	8.8	38,978	074039	Minthorn
	100,791			81,046		
86	50,480	Apr 88	10.2	39,509	074036	Bonifer
86	49,070	Apr 88	10.2	38,405	074037	Bonifer
	99,550			77,914		
87	1,886,757	May 88	68.3	198,285	075007	Uma RM 23
87	4,823	Nov 88	9.8	4,438	074539	Minthorn
87	4,660	Nov 88	9.8	4,289	074540	Minthorn
87	4,925	Nov 88	9.8	4,533	074541	Minthorn
	14,408			13,260		
87	26,858	Nov 88	8.6	24,656	074536	Nr Minthorn
87	25,493	Nov 88	8.6	23,403	074537	Nr Minthorn
87	27,330	Nov 88	8.6	25,089	074538	Nr Minthorn
	79,681			73,148		
88	797,904	May 89	75.0	52,228	074646	Uma RM 22
88	797,903	May 89	75.0	49,771	074647	Uma RM 22
88	797,903	May 89	75.0	52,244	074648	Uma RM 22
	2,393,710			154,243		
88	26,770	Oct 89	10.9	26,358	074753	Minthorn
88	26,617	Oct 89	10.9	25,028	074754	Minthorn
88	25,438	Oct 89	10.9	25,438	074757	Minthorn
	78,825			76,824		
88	27,071	Oct 89	11.1	26,790	074758	Nr Minthorn
88	25,428	Oct 89	11.1	24,285	074760	Nr Minthorn
88	25,633	Oct 89	11.1	25,350	074763	Nr Minthorn
	78,132			76,425		

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(Wetzel 1975), that low DO for the night occurred just before sunrise (Appendix C). Dissolved oxygen fluctuated, but was still relatively low by the time fish were to be transferred into the facility. An auxiliary oxygen system was set up to bubble oxygen into the water after it left the pump. Although DO readings taken early in the mornings previous to acclimation did not show excessively low DO (September 7, 14 & 21), the oxygen levels in 1988 fluctuated daily and were excessively low during acclimation, despite being above 7.0 before the fish went into the facility. Supplemental oxygen was set up and turned on most evenings and turned off in the morning. All water exiting the raceways was recirculated into the intake pond, because DO at the outlet of the raceway was generally higher than "new" water flowing in from the spring. Presumably some aeration occurs during plunging and mixing at the head of the raceway and plunging through the metal grating at the outlet to account for these higher DO readings compared to the spring source, even without supplemental oxygen.

Fish were transferred 9/27, and about 3,000 fish were noted dead coming directly out of the truck from one particular compartment. The agitator in that compartment was suspected, as problems earlier in the day had been encountered, and fish in the other compartments had not experienced high mortality. Transfer mortality was 3,226, while total mortality was 3,267. Moribund fish were specifically checked for Ichthionhthirius at least every one to three days. This procedure was done as a precautionary measure because "Ich" has been a problem in the fall at both acclimation facilities. This procedure helped assure "Ich" could be detected and treated before a large-scale epizootic occurred. No "Ich" was observed on the skin or gills of any moribund fish. Moribund and live fish were checked for evidence of gas bubble disease after the extremely high DO on the morning of 10/3. No bubbles were observed on the skin, eyes or gills of the fish examined. Fish were fed 0.94% body weight of food per day.

The DO at the head of the raceway was at or above 7.0 every day at the head of both raceways but was below 7.0 at the outlets several times (9/28, 30, and 10/13, 14, & 18) despite having the oxygen turned on most of these occasions. The range was from 6.0 to 14.8 ppm. The high DO on 10/3 was a result of incorrect pressure adjustment on the oxygen tank. Temperature ranged from 8.1 to15.2 and averaged 11.9 degrees C (Appendix B).

Length frequencies for marked and unmarked fish were not differentiated because 100% were supposed to be marked. The length frequency for acclimated fish was about the same as unacclimated fish (Figure 6). None of the acclimated or control fish were considered to have severe descaling, while partial descaling was 5% for acclimated fish and 85% for control fish (Appendix D). A higher percentage of the control fish were reported as being smolted than the test fish (79% versus 13% respectively)(Appendix D). This may account for some of the increased descaling observed.

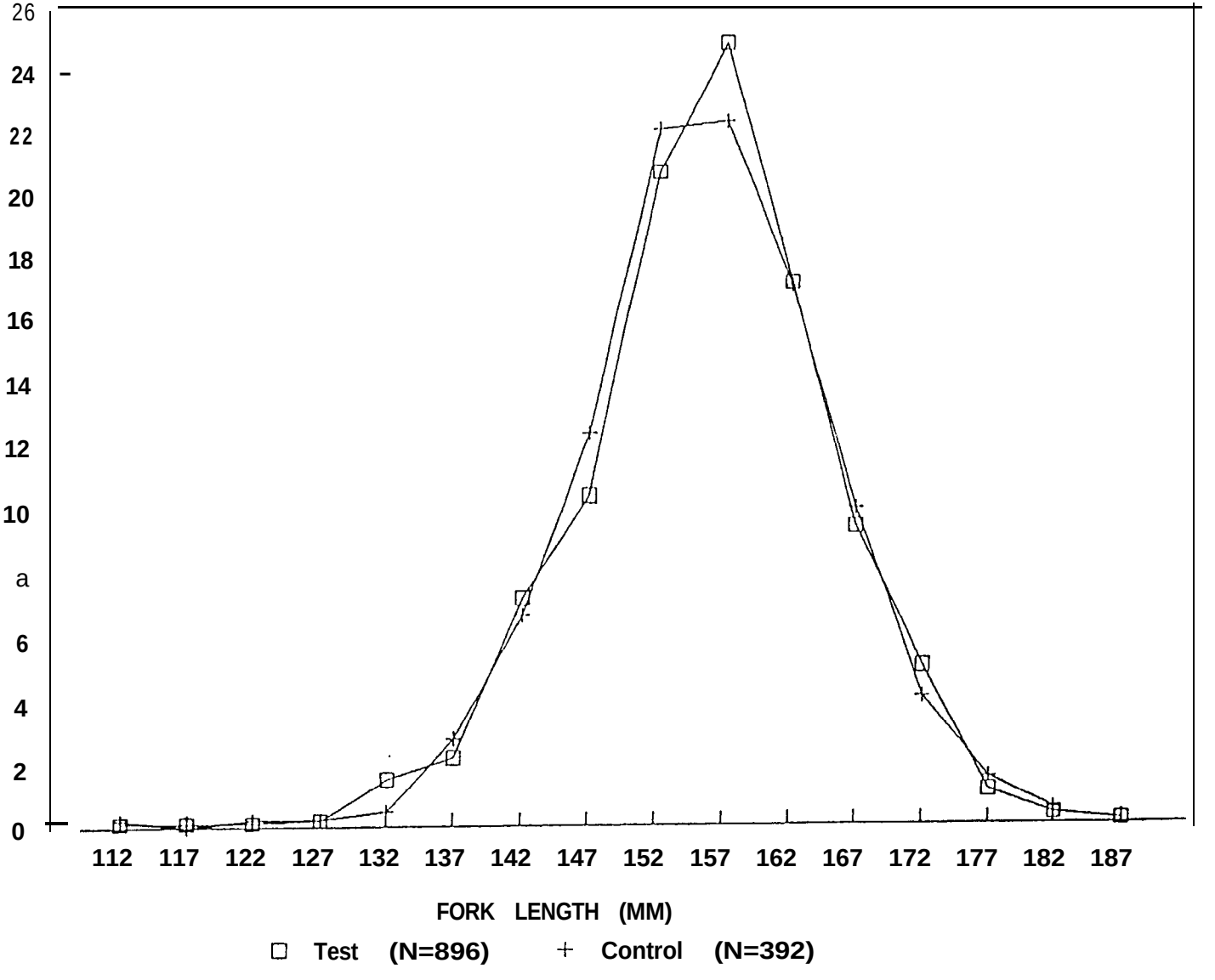

Figure 6. Length frequencies of experimental groups of fall chinook salmon released at Minthorn Acclimation Facility on 10-18-89-test versus control group.

The fish were released on l0/18 **at** 10.9/lb. The total number of fish was 78,825 with 76,824 tagged fish (Table 13). A control group of 78,132 fish from Irrigon Hatchery was released concurrently **at** Minthorn at ll.l/lb., 76,425 of which were tagged (Table 13).

Acclimation at Bonifer

Spring chinook salmon - 3/7 to 5/23

The first lot of fish acclimated at Bonifer in 1989 consisted of 1987 brood yearling spring chinook salmon (Table 8). ODFW transferred the fish from Bonneville Hatchery to Bonifer on 3/7-8. Fish were coded-wire tagged with 3 tag codes (Table 14). Transfer mortality was 183 while observed total mortality recorded over the acclimation period was 815 fish. Because silt and vegetation cover much of the bottom of Bonifer, observed mortality is not a total count, however few plants had grown by this time and this count was considered relatively accurate. The small count indicates that heavy mortality did not occur. Temperature from 3/8 to 3/28 ranged from 3.5 to 9.5, averaging 6.8 degrees Celsius (Appendix E). Dissolved oxygen ranged from 8.6 to 11.0 ppm at the outlet (Appendix F). Dissolved oxygen in the springs never got below 10.0 ppm. Fish were fed 0.54% body weight of food per day.

On the morning of 3/10, the outlet screen was found blocked with so much aquatic vegetation that water had flowed around the side of the pond, allowing fish to escape. Thereafter, the screens were cleaned upon arrival and departure for both morning and afternoon feedings, and Bonifer was visited an extra time each day specifically to clean the screens until vegetation build-up was no longer a problem. A counter was rented and installed to determine how many of the fish had been acclimated at least the full 21 days. The counter was switched to one-way counting (two-way, upstream and downstream had been used together in the past, but upstream movement had been minimal). One-way mode was considered more accurate for a downstream count. However, a count of 98,809 suggested that, in this case, upstream movement was taking place. Only about 80,000 fish had been tranferred into the pond, and a few had already escaped. The counter was switched to two-way mode and the suspected movement was confirmed. The electronic count was considered inaccurate and the number of fish that escaped could not be determined. We were able to draw down the pond to about two feet at the outlet, and seining revealed that almost all of the fish in the pond had left. However, a few thousand fish migrated up the largest spring over the cobble barrier near the pond and over a temporary damboard barrier at the outlet of the lowest pool above the pond. Observation during the steelhead acclimation showed that most of these fish migrated back down into the pond and many were found during pre-release sampling for the steelhead acclimation. The release time is reported as March 10 to May 23

Table 14. Liberation information for all spring chinook salmon coded-wire tagged and released in the Umatilla River Basin.

Brood	Total number	Release time	Size (#/lb.)	Number tagged	CWT code	Release location
86	35,946	Mar-Apr 88	10.1	26,640	074325	Bonifer
86	35,148	Mar-Apr 88	10.1	25,863	074326	Bonifer
86	35,137	Mar-Apr 88	10.1	25,853	074327	Bonifer
	106,231			78,356		
86	34,187	Apr 88	8.7	26,319	074328	Uma RM 23-69
86	33,573	Apr 88	8.7	25,722	074329	Uma RM 23-69
86	34,118	Apr 88	8.7	26,252	074330	Uma RM 23-69
	101,878			78,293		
87	416	Nov 88	21.4	410	074420	Bonifer
87	399	Nov 88	21.4	393	074423	Bonifer
87	381	Nov 88	21.4	376	074424	Bonifer
	1,196			1,179		
87	26,109	Nov 88	11.1	25,987	074427	Uma RM 89
87	24,183	Nov 88	11.1	24,070	074429	Uma RM 89
87	25,475	Nov 88	11.1	25,356	074430	Uma RM 89
	75,767			75,413		
87	26,135	Mar-May 89	10.6	25,427	074433	Bonifer
87	27,756	Mar-May 89	10.6	27,004	074434	Bonifer
87	26,093	Mar-May 89	10.6	25,386	074436	Bonifer
	79,984			77,817		
87	28,153	Mar 89	10.6	27,585	074439	Mea Ck 2
87	28,116	Mar 89	10.6	27,550	074440	Mea Ck 2
87	24,663	Mar 89	10.6	24,165	074443	Mea Ck 2
	80,932			79,300		
88	24,968	Oct 89	12.0	24,801	075063	Bonifer
88	28,299	Oct 89	12.0	28,109	075101	Bonifer
88	27,483	Oct 89	12.0	27,299	075102	Bonifer
	80,750			80,209		
88	27,287	Oct 89	12.0	27,137	075103	Mea Ck 2
88	28,718	Oct 89	12.0	28,560	075104	Mea Ck 2
88	27,848	Oct 89	12.0	27,695	075105	Mea Ck 2
	83,853			83,392		

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because some of the fish escaped as early as this date with the clogging of the outlet and as late as the last date of the steelhead acclimation. A temporary screen was added across the damboards to prevent upstream migration during the steelhead acclimation and the spring chinook salmon acclimation in the fall.

Fish were released at 10.6/lb. (Table 8). Of the 79,984 fish that were released, 77,817 had coded-wire tags (Table 14). No fish were observed in the pond on the morning of 3/31. Stoplogs were replaced to refill the pond. Length frequencies of acclimated and unacclimated fish were similar (Figure 7). One percent of the acclimated and none of the control fish had severe descaling. The amount of partial descaling for acclimated and control fish was 21% and 24% respectively (Appendix D). The smoltification indices for test and control groups were similar (Appendix D.)

Summer Steelhead - 4/4 to 5/18

The second lot of fish acclimated at Bonifer was gradeouts from yearling fish that were used for experiments at Minthorn (Table 8). ODFW transferred fish to the Bonifer Facility on 4/4-5. Fish had adipose fin clips only. Transfer mortality was 367 while total mortality was 430. Temperature during acclimation ranged from 5.5 to 16.2, with an average of 9.9 degrees Celsius (Appendix El. Dissolved oxygen ranged from 8.0 to 11.1 ppm at the pond outlet (Appendix F). Dissolved oxygen was never below 8.4 at either of the major springs, although it dipped as low as 7.0 at the smallest spring, which flows the shortest distance before emptying into the pond. Fish were fed 1.26% body weight of food per day.

An estimated 22,274 fish were released at 5.5/lb. (Table 8). Length frequency of the fish appeared to be bimodal (Figure 8). None of the fish had severe descaling, while 9% were considered partially descaled (Appendix D). The smoltification index is given in Appendix D.

We were able to keep these fish, as well as those at Minthorn, in the pond longer this year because flows in the Umatilla River did not drop as precipitously as they have in past years.

Spring chinook salmon - lO/lO-13

The third lot of fish acclimated at Bonifer was subyearlings from the 1988 brood of spring chinook salmon reared at the Bonneville Hatchery (Table 8). There have been problems with low dissolved oxygen and disease during long-term (three weeks) acclimation of fish in the fall at Bonifer in the past. In addition, the environment is less controllable (three separate spring inlets for oxygen supplementation or disease treatment) than that at Minthorn. ODFW pathologists and CTUIR recommended not pursuing full-term acclimation in the fall. One alternative was a

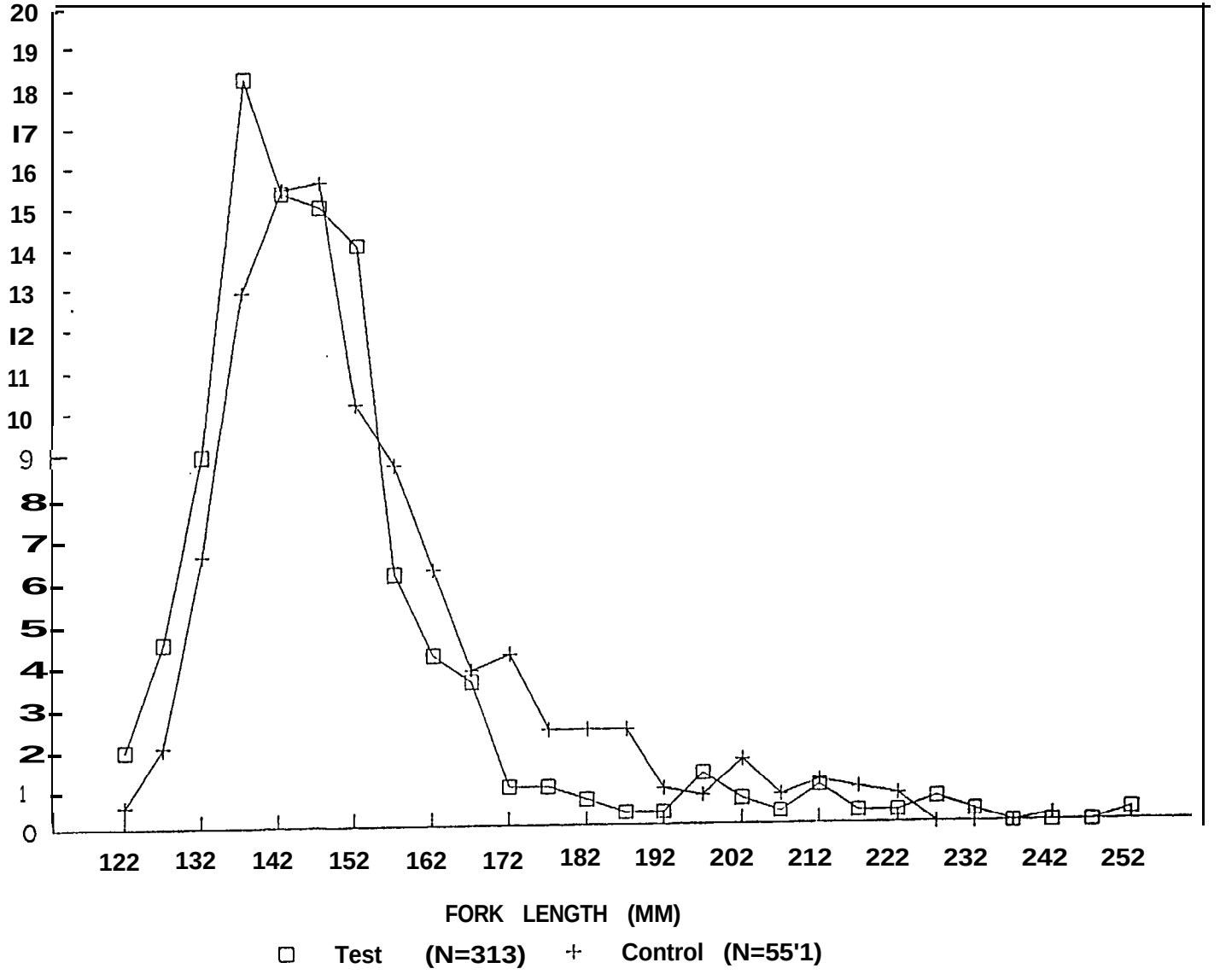

Figure 7 Length frequencies of spring chinook salmon released at Bonifer Acclimation Facility between 3-10-89 and 5-23-89 - test versus control group.

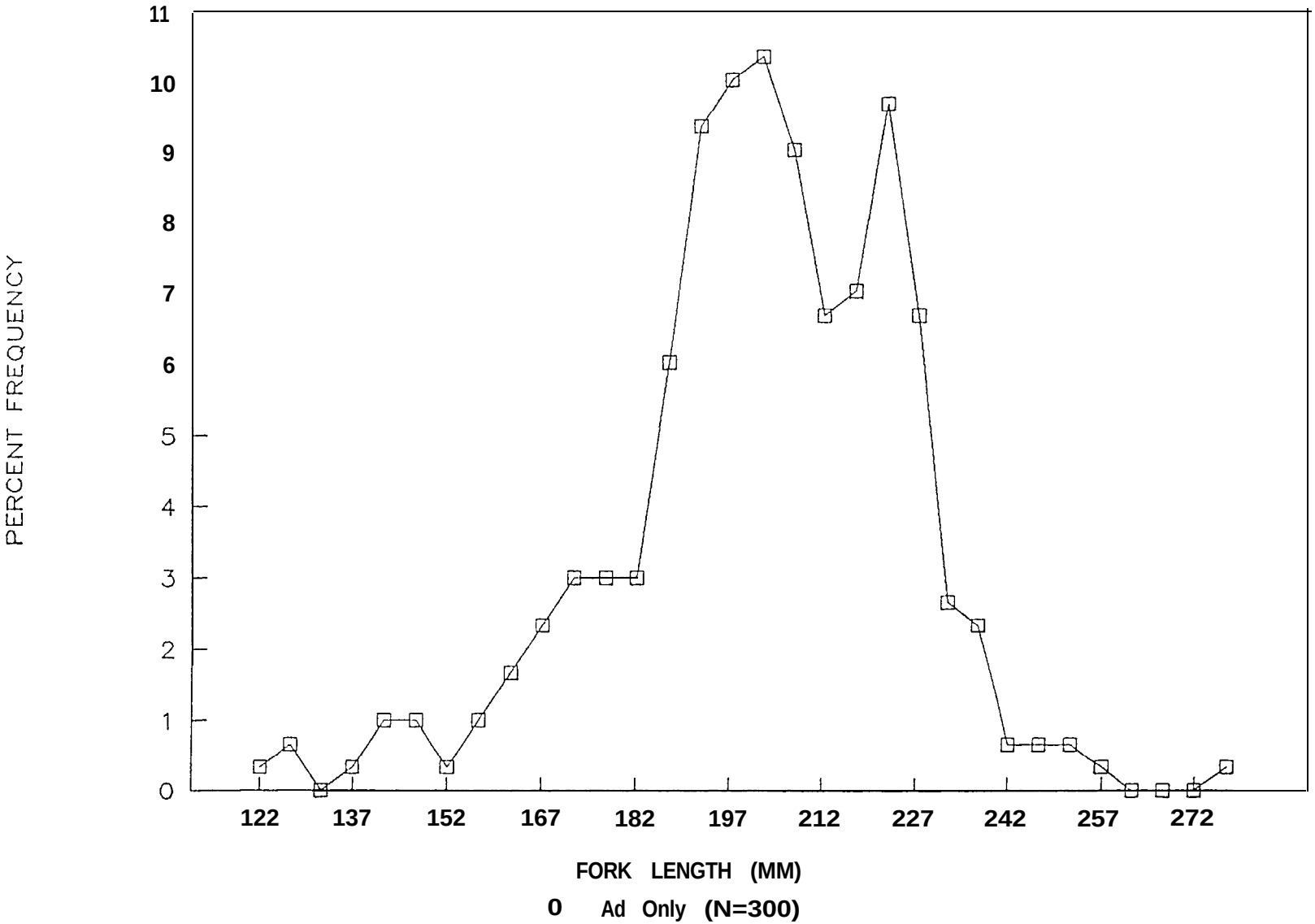

Figure 8. Length frequency of Ad only summer steelhead released at Bonifer Acclimation Facility on 5-18-89.

short-term acclimation to recover from trucking. The fish were held three days without feeding and released.

Bonifer was partially cleared of aquatic vegetation in the deep water areas of the pond the week before the fish transfer. This was achieved by dragging a weighted rope across the pond bottom. Vegetation floating to the surface (rooted aquatics) was flushed out of the pond by pulling some stoplogs. The process proved to be very labor-intensive and only marginally successful. About a third to half of the vegetation had been removed in the treated area.

Pre-release sampling for both the test and control groups was completed at the hatchery the day before transfer of the group that was to be acclimated. Supplementary information taken by CTUIR showed very low hematocrits, possibly indicative of EIBS. ODFW pathologists in Corvallis were informed the next morning. Fish from the control group were sampled and diagnosed as having EIBS. Acclimated fish were transported before they could be sampled, but were presumed to have the disease as well. The fish did not show any unusual mortality from transfer, and appeared in good health when they were put into Bonifer on lO/lO. Test and control groups were each coded-wire tagged with three different tag codes (Table 14). Mortality at Bonifer was estimated at 21. Temperature during acclimation ranged from 11.8 to 14.7, with an average of 12.8 degrees Celsius (Appendix E).

Two sites for dissolved oxygen readings and temperature were added to the data base for Bonifer on 5-6. These two sites were in the vicinity of the areas that Fish Management Consultants Inc. recommended for raceways in its report "Review of Bonifer Spring culture operations and recommendationst'. Dissolved oxygen data from the inlets of the two largest springs during August and September through the week in October before transfer were always greater than 7 ppm. Water from the largest spring was at least 8 ppm during this time. Dissolved oxygen at the outlet on the day of transfer was 8.8 ppm (Appendix F).

After transfer, DO at the outlet dropped considerably. At the inlet of the largest spring DO was as low as 6.0 ppm. Although the water at midpond was above 6 ppm, the outlet dropped to below 5 ppm. The additional oxygen demand of the fish and the decaying plants apparently depleted the available oxygen supply.

Acclimated and unacclimated fish were released on **10/13** at the same size of 12.0/lb. Of the 80,750 acclimated fish released, 80,209 were tagged. Of the 83,853 control fish released, 83,392 were tagged (Table 14). Length frequencies of test and control fish were similar (Figure 9). None of the acclimated or control fish had severe descaling, while both groups had 1% partial descaling (Appendix D). The smoltification indices for test and control groups were similar (Appendix D).

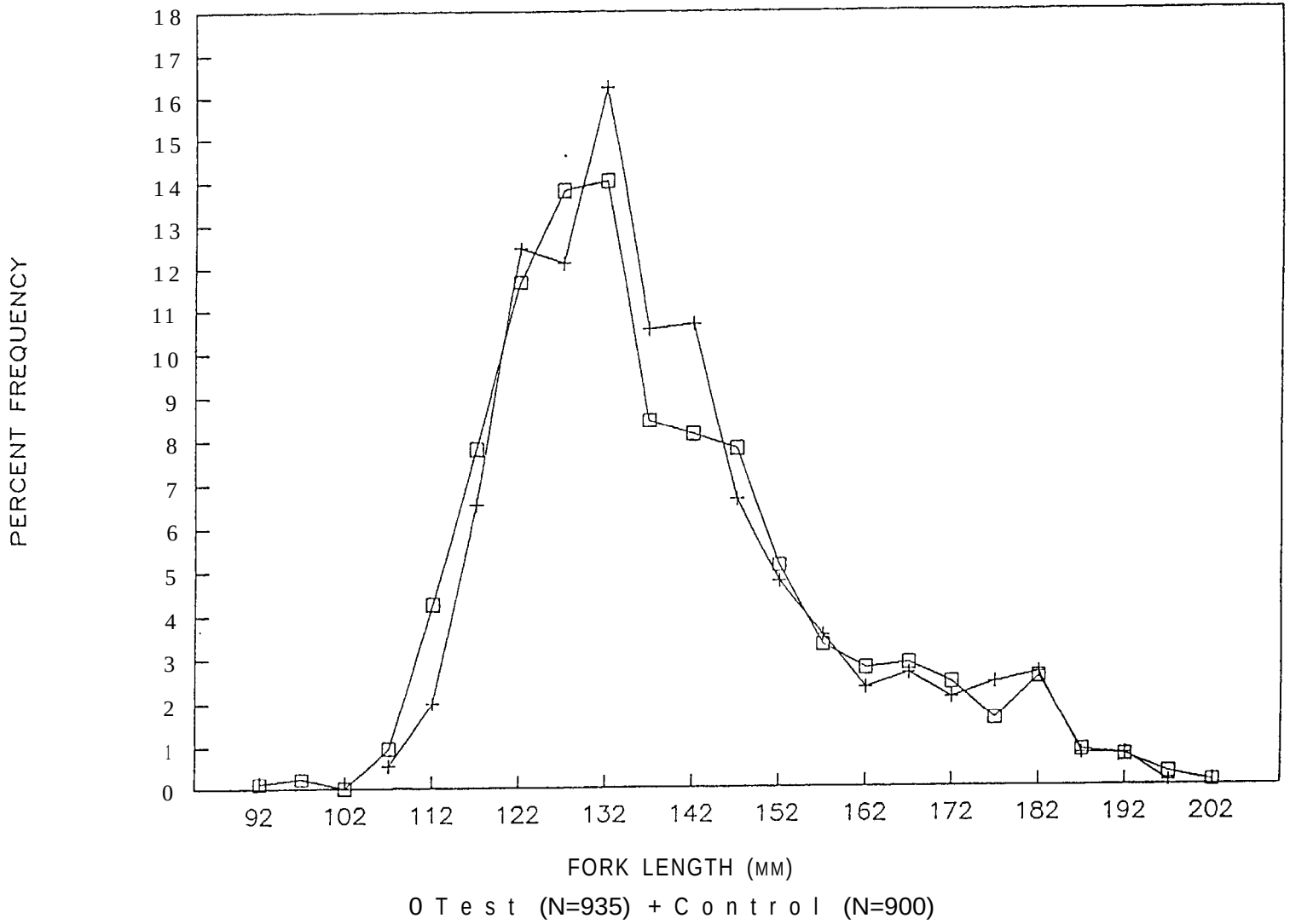

Figure 9. Length frequencies of experimental groups of spring chinook salmon released at Bonifer Acclimation Facility on lo-13-89- test versus control group.

Outmigration Monitoring

The Westland juvenile salmonid trap was set on 4-3-89 and data were collected between 4-4 and 7-14 when the trap was closed. Coded-wire tagged coho salmon released from Minthorn on 3-31 showed up at the trap 4 days later on 4-4 (Table 15). Coded-wire tagged spring chinook also showed up at the trap on 4-4, 25 days after some of the fish escaped from Bonifer on 3-10. Both species however, may have passed by Westland before the trap was opened. The number of coho and spring chinook captured at the trap dropped off significantly in early June. Adipose fin clipped summer steelhead were released from Bonifer on 5-23 and yet eight were captured in the trap between 4-23 and 5-4 (Table 15). Adipose and left ventral fin clipped fish were released from Minthorn on 5-17 but several were captured at Westland on 5-15. Because the captured fish were within the size range of those released, it is assumed that they escaped from both facilities. If they were resisuals from the previous year, they would have been much larger. The number of summer steelhead captured at the trap peaked in early June and began to taper off by the end of the month.

Both the test and control groups of coho showed no descaling at release but the amount of partial and total descaling at the trap averaged 40% throughout the trapping period (Appendix G). The descaling indices for the chinook at release and at the trap were similar. The amount of partial and total descaling for summer steelhead at release was 3-4% but increased to 67% at the trap. It is difficult to determine whether the descaling occurred during migration or at the trap.

The number of coho reported as being smolted changed considerably through the trapping period. In April, a higher percentage of the fish were reported as intermediates but in June, a higher percentage were reported as being smolted (Appendix H). Between 43% to 49% of the chinook were reported as smolts at release while 86% were reported as smolts at the trap. Between 78 to 89% of the summer steelhead at release were reported as intermediates and smolts while the percentage increased to 100% at the trap. The numbers of chinook and summer steelhead sampled at the trap were small however, and general population trends are difficult to determine for those species.

Assessment of Acclimation Facilities

Fish Management Consultants, Inc. conducted a study of the Minthorn Acclimation Facility in 1989 similar to the one completed for Bonifer in 1988. They were contracted to evaluate the adult and juvenile carrying capacities of the facility and to review and recommend improvement to achieve the operational goals.

The Minthorn Facility goal is to acclimate and release 3

Table 15. Estimated number and daily rate of juvenile salmonids captured at Westland juvenile salaonid trap in 1989. l/

	Samples					Daily rates			
Date	Steelhead	Coho	Chinook salmon	Non-sampled fish	Days 2/	Steelhead	Coho	Chinook salmon	Percent sampled/3
4-4	0	78	7	0	1	0	78	7	100
4-7	0	132	4	0	3	0	44	1	100
4-12	0	193	9	30	5	0	44	2	87
4-16	0	47	13	0	4	0	12	3	100
4-20	0	50	21	0	4	0	13	5	100
4-23	5	24	5	0	3	2	8	2	100
4-24	0	27	15	0	1	0	27	15	100
4-30	1	18	4	0	6	0	3	1	100
5-4	2	40	5	0	4	1	10	1	100
5-15	21	122	5	830	11	5	81	3	15
5-23	35	1	12	0	8	4	0	2	100
5-25	9	4	2	0	2	5	2	1	100
6-2	40	29	11	0	8	5	4	1	100
6-6	80	10	0	455	4	121	15	0	17
6-7	172	0	69	0	1	172	0	69	100
6-8	98	16	0	124	1	203	35	0	48
6-9	117	0	30	0	1	117	0	30	100
6-10	---	---	---	50	1	---	---	---	0
6-11	27	10	0	0	1	27	10	0	100
Ii-12	17	0	0	0	1	17	0	0	100
6-13	41	4	0	0	1	41	4	0	100
6-14	14	0	0	0	1	14	0	0	100
6-15	9	2	1	0	1	9	2	1	100
6-16	12	0	0	0	1	12	0	0	100
6-19	12	3	0	0	3	4	1	0	100
6-22	4	0	3	0	3	1	0	1	100
6-28	5	3	1	0	6	1	1	0	100
					Season	760	315	139	

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l/ Source: CTUIR Fisheries Office (Trap and Haul),
2/ The number of days that the trap was run that produced the actual sample,
3/ Percentage sampled of total fish for the time period,

groups of juvenile salmonids and hold no less than 267 - 7 lb. steelhead adults for spawning (NOMP 1989). Species-specific carrying capacities to meet these juvenile acclimation goals were calculated in the FMC report (Tables 16 & 17).

The report states that available space and flow is sufficient to acclimate the spring releases, but not the fall release when an additional 100 gpm of water flow is needed. The report also states that an additional 300 cubic feet of space is needed to hold 267 steelhead adults.

Seven operational goals discussed are summarized as follows:

1. Reduce late summer and fall temperatures.
2. Increase brood stock holding capacity.
3. Increase level of oxygen for rearing.
4. Reduce sediment and algae.
5. Better control of upstream environmental factors that relate to disease outbreak.
6. Improve facility for adult handling and spawning and effective operational procedures.
7. Operational recommendations.

The study proposed alternative solutions to each of the goals and made recommendations as follows:

1. Obtain spring water near the source and deliver it with a pump and pipeline.
2. First study tube holding and if not successful, add 300 cubic feet of space and install a corrugated metal pipe riser in the pump house reservoir with a drain to the river.
3. Slightly raise the lower header pipe, then add modified pack columns.
4. Same as goal #l.
5. Same as goal #l.
6. Complete a concrete slab at a time when conducting other construction work.
7. Refer to FMC report.

An extensive temperature and DO monitoring program at both acclimation facilties was conducted in 1989. Temperatures and D.O. measurements that were recorded at the facilities during acclimation are reported in association with each particular acclimation. Detailed data for the year are presented in Appendices B, C, E and F.

Two sites were added to the database for both Minthorn and Bonifer. One location is at the site of the intake proposed by Fish Management Consultants, Inc. to pipe water down to Minthorn. Baseline data were collected to help determine if potential

Table 16. Minthorn acclimation goal.

Species	Number	Release Pounds	Fish/ Lb.	Acclimation Period
Upriver bright fall chinook	75,000	6,250	12	Sept.-Oct. 30
Upriver bright fall chinook	455,000	5,050	90	April 15-May 20
Summer steelhead	52,000	10,500	5	March-April 15

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Table 17. Space and flow available and needed at Minthorn Springs.

Species	Release Group	Available GPM\l	Approx. Needs GPM\2	Available Cubic ft.	Approx. Needs Cubic ft.\3
Fall chinook	October	900	1,000	8,640	6,000
Fall chinook	May	1,350	1,000	8,640	8,000
Steelhead	April	2,000	1,300	8,640	8,000

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\l Flow is based on Department of Interior U.S.Fish and Wildlife August 1980 report titled "Anadromous Fish Production Facility Study on the Umatilla Indian Reservation".

\2 Flow is estimated by using Harry Wester's formula of 4 times available oxygen divided by the percent food fed and given we have 95% oxygen saturation on the raceway inflow and 7 ppm on the outflow.

\3 Space is approximated using Piper's (1982) density index of 0.175 or 0.175 times fish length equals lbs. of fish/ft.3. This is the factor accepted in the Yakima Master Plan and may be slightly conservative for fall chinook and steelhead but most appropriate for spring chinook.

benefits of lowering water temperature and increasing dissolved oxygen could be attained by piping the water directly from the spring source. The data suggest that there would be little change in temperature regime if the water was piped. Temperatures at both the proposed pipe intake and the present pump intake were usually within one to two degrees Celsius. Dissolved oxygen readings at the two sites were similar during May and June. In July and August dissolved oxygen at the proposed intake was almost always higher (as much as 3 ppm) than at the pump intake. This situation was reversed about the first of September, when DO readings were usually lower at the pipe intake. On September 29, the standard time at which data were taken was changed to more closely approximate the lowest DO to which fish were exposed. Data were taken at about one hour before official sunrise at the facility and shortly thereafter at the proposed intake. During acclimation in the fall of 1989, dissolved oxygen at the proposed intake was consistently lower than at the pump intake. A lag time might explain a slight difference in DO between the two sites. But the data suggest that, at least for 1989, piping of water to circumvent the slow flow through the area backed up behind the beaver dam would produce little if any increase in oxygen at the pump intake. Therefore, use of the pipeline in the fall to increase D.O. may not be successful. Data taken in 1990 will provide some replication to determine if this is a usual occurence. The second site for data collection added in the fall at Minthorn was just above the beaver dam next to the facility. This provided a comparison of DO of "new" spring water to that at the outlet of the raceways. On almost all occasions during acclimation, the water exiting the raceway had a higher DO than the new water. Because reused water had a higher DO, all water exiting the raceways was diverted back to the pumping pool.

At Bonifer, two sites were added along the upper reach of the largest spring to profile water quality in the vicinity of the proposed raceways. The data also provide a profile of the current major water source for the pond near its source. Starting in May the DO at the proposed sites closely followed that of the DO of the lower spring before entry into the pond. Dissolved oxygen was about 8.0 ppm or higher until about August. After August DO ranged from 6.0 to about 7.5 through the rest of the year. Any design for raceways to be installed in these areas should take into account low DO if fish are to be acclimated during these periods and incorporate some sort of aeration. The low flow and the low dissolved oxygen of the water flowing into the pond were not sufficient to maintain oxygen in the pond at an acceptable level **for a long period of time. Putting fish in Bonifer in the** fall of 1990 without some additional aeration or additional water is not recommended. The most feasible of these two solutions would be a temporary installation of an aerator or dissolved oxygen in the middle of the pond as suggested by Fish Management Consultants, Inc.(FMC 1989).

Research

Taqqinq-Subcontract

Each test or control group consisted of three replicates. Numbers reported are fish tagged. Numbers released differ due to mortality.

A test group of fall chinook salmon totaling 79,672 fish was tagged in May. Fish were acclimated at Minthorn and released in October. A control group totaling 78,785 fish was tagged and released directly into the stream near Minthorn at the time of the acclimation release (Table 18).

Four groups of spring chinook salmon were tagged in August for the study. A test group totaling 80,938 fish was tagged and acclimated at Bonifer in October. The control group totaling 84,151 fish was tagged and released directly into the stream at the time of the acclimation release (Table 18). A test group of spring chinook salmon totaling 80,801 fish was tagged and will be acclimated at Bonifer in the spring of 1990. A control group totaling 81,559 fish was tagged and will be released directly into the stream at the time of the acclimation release (Table 18).

Two groups of summer steelhead were tagged for the study in October. A test group totaling 30,154 fish was tagged and will be acclimated at Minthorn and released in the spring of 1990. A control group totaling 30,195 fish was also tagged and will be released directly into the stream at the time of the acclimation release (Table 18).

Collection of snouts from coded-wire taqqed fish

The snouts from fall chinook salmon with adipose fin clips were collected at Threemile Dam in the 1988-89 season. Taken from the trap were 16 subjacks, 147 jacks and 96 adults. Additional fish snouts from fall chinook salmon were also collected from spawning ground surveys conducted below Threemile Falls Dam through funds provided by Bureau of Indian Affairs. Spawning was observed in a few gravelly areas between the mouth and the dam and snouts were collected from 1 jack and 20 adults. Size categories for all of these fish were defined as <458mm for subjacks, 458-609 for jacks and > 609 for adults. The arbitrary cutoff for subjack size was determined by CTUIR biologists who examined the length frequency information for the fall chinook salmon run in 1987-88. The cutoff between jacks and adults is that used in the fishing regulations for the State of Oregon (24 inches).

Snouts from 28 spring chinook jacks were taken. No coded-wire tagged adults have returned. One hundred twenty-eight snouts from the first returns of coded-wired tagged steelhead were also collected. All snouts were delivered to ODFW for tag

Table 18 , Coded-wire tagging of juvenile salmonids in 1989 for release in the Umatilla River,

Species	Brood	Hatchery	Mark	Size (#/lb,)	Month Tagged	Release	Release Site	No, Tagged	CWT Code
Fall chinook	88	Irrigon	AD	120	May 1989	October 1989	Minthorn	27,058 26,903 25,711 --- 79,672	074753 074 754 074757
Fall chinook	88	Irrigon	AD	120	May 1989	October 1989	Nr.Minthorn	27,297 25,641 25,847 --- 78,785	074758 074760 074763
Spring chinook	88	Bonneville	AD	20	August 1989	October 1989	Bonifer	25,026 28,365 27,547 --- 80,938	075063 075101 075102
Spring chinook	88	Bonneville	AD	20	August 1989	October 1989	Hr. Bonifer	27,384 28,820 27,947 --- 84,151	075103 075104 075105
Spring chinook	88	Bonneville	AD	30	August 1989	April 1990	Bonifer	27,011 26,526 27,264 --- 80,801	075106 075107 075108
Spring chinook	88	Bonneville	AD	30	August 1989	April 1990	Nr. Bonifer	27,096 27,832 26,631 --- 81,559	075109 075110 075111
Summer steelhead	89	Oak Springs	AD&LV	65	October 1989	May 1990	Minthorn	10,215 9,998 9,941 --- 30,154	075212 075213 075214
Summer steelhead	89	Oak Springs	AD&LV	65	Novenber 1989	May 1990	Nr,Minthorn	10,080 10,095 10,020 --- 30,195	075215 075216 075217

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identification.

Adult Survival and Umatilla River Returns

Methods

Data presented for all marine recoveries were retrieved from the Pacific States Marine Fisheries Commission (PSMFC) through computer access. Freshwater recoveries from 1983 through 1988 were also retrieved from the PSMFC data bank. Oregon and Washington freshwater recoveries in 1989 were provided for by Charlie Corrarino, ODFW, and by Lynn Anderson, Washington Department of Fisheries. Data for 1989 are preliminary, and should be considered as such. All fish reported by PSMFC are included in this report, including fish for which no expansion (estimated number) was available. For these fish, the observed number **was** used. All information was summarized in tabular form for each tagcode. Recovery information for fall chinook salmon is discussed and compared for those releases when fish at least four years old have been recovered. Recovery rates of tagcodes for which only younger fish have been recovered are discussed relative to other return rates for early years, because recoveries are incomplete.

Expanded numbers for recoveries in the ocean, Columbia River and Umatilla River are calculated. In instances where tagged fish were not treated the same as untagged fish (eg. tagged fish were released at **a** different area or time than the untagged fish), expansions were calculated only for those fish treated similarly. Releases for fall chinook salmon occurred as subyearling and yearling fish. For discussion of recoveries of adults from these releases, fish recovered in the same year as release were not considered. Detailed information on recoveries is presented in Appendices I, J, K and L.

Results

Summer Steelhead

Since 1975, all Umatilla River summer steelhead releases have been from unmarked Umatilla River brookstock. The first coded-wire tagged releases were in April of 1988 (Table 19). An acclimated group was released from Minthorn while a control group was released into the Umatilla River near Minthorn. The purpose of the experiment was to evaluate acclimation.

Recovery rates of l-salt fish were higher in the acclimated group than they were in the non-acclimated group (0.27 versus 0.20%, respectively), despite the larger size of the non-acclimated fish at release (Table 19). Carmichael et al. (1988), have shown that survival of steelhead released in the Snake River basin may be higher for fish released at a larger size.

Table 19, Liberation and survival inforaation for summer steelhead released in the Umatilla River, /1

Brood	Number Released	Date of Release	Size at Release	Wunber Tagged	CUT Code	Release Location	Estinated Adult Survival %	Total	Oregon Col. R, Gillnet	Sport	Fish Trap
87	10187	Apr 88	7.4	9829	013859	Minthorn	0.18	18	6	0	12
87	10075	Apr 88	7.4	9121	073860	Minthorn	0,31	32	16	0	16
87	10287	Apr 88	7,4	9925	073861	Minthorn	0,31	32	10	0	22
Total	30549			29415			0.27	82	32	0	50
87	10423	Apr 88	6,5	9689	013856	Nr, Minthorn	0.22	23	0	1 /2	22
87	10171	Apr 88	6,5	9455	013857	Nr, Minthorn	0,29	29	9	0	20
87	10163	Apr 88	6,5	9448	013858	Hr. Minthorn	0.07	8	0	0	8
Total	30757			28592			0,20	60	9	1	50

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/1 The survival data includes I-salt fish only (1989-90 returns).
/2 Caught at mouth of Deschutes River.

Approximately 70.4% of the fish were recovered at Threemile Falls Dam on the Umatilla River and approximately 28.9% were recovered in the Columbia River gillnet fishery. One fish was caught in the Deschutes River sport fishery. Thirty-nine percent of the acclimated fish and only 15.0% of the non-acclimated fish recovered were captured in the Columbia River gillnet fishery.

A creel census survey (stratified random design) was conducted in 1989 by CTUIR, with funding from Bureau of Indian Affairs, between Threemile Falls Dam and the mouth of the Umatilla River. No coded-wire tagged fish were observed.

Fall Chinook - Tule stock

Initial releases of fall chinook salmon in the Umatilla River were subyearling Tule stock (Table 20). The fish with tagcodes 050851 and 051057 were tagged by the National Marine Fisheries Service and were reared at Spring Creek National Fish Hatchery (NFH). The fish with tagcode 072663 were tagged by ODFW and were reared at Bonneville State Fish Hatchery (SFH). All the fish were from eggs collected at Spring Creek NFH. They were released at 79 to 92/lb., respectively, in April, 1982, at RM 1.5 and 51.5 (Table 20).

Survival rates ranged from 0.43 to 0.52% (Table 20). These rates are at the lower end of the range experienced by Spring Creek NFH (0-2.1%), but higher than many other releases of Tule stock from Spring Creek NFH released at other locations. Most fish were recovered as age-3 fish, similar to reports for fish from the 1978 and 1979 brood years released elsewhere (Howell et al. 1985).

Exploitation (commercial, sport and treaty catches) of Tule stock was 99.3% for all releases (unweighted for size of release grow). Ocean and Columbia River gillnet catches were similar (48.1 and 41.6%, respectively). Sport and treaty exploitation rates were 7.3 and 2.4%, respectively.

Fall Chinook - Bonneville stock

All releases since 1982 have been of Bonneville and Priest Rapids upriver bright stock. The first liberations of fish from Bonneville stock were from adult returns to Bonneville SFH with some fish taken from Bonneville Dam. Early releases of subyearlings were near the mouth of the river because of potential for fish loss due to unscreened or partially screened irrigation diversions. Yearlings could be released farther upstream. For purposes of discussion, fish are grouped by age of release and release location (lower Umatilla River and upper Umatilla River and its tributaries). Releases in the upper river include those made at the Minthorn and Bonifer Acclimation Facilities.

All releases in the lower river were made with subyearling

Table 20. Liberation and survival inforaation for fall chinook salaon released in the Umatilla River, /1

Br. Yr, Stock/2	Number Released	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	%	Estinated Adult Survivals /3 Total	Ocean	Col,R,	Uma,R.
81 T	306279	Apr 82	79.0	46707	050851	Umatilla R. /4	0.45	1377	741	636	0
81 T	672057	Apr 82	79,0	102331	051051	Umatilla R, /4	0.52	3481	1997	1484	0
Total	918336			149038			0,49	4858	2738	2120	0
81 T	2828835	Apr 82	9200	102386	072663	Umatilla R,(RM 1.5)	0.43	12240	6880	5360	0
81 B	100564	Mar 83	5.9	99570	072741	Bonifer & Meacham Cr.	0,16	/5 159	86	71	2
82 B	228412	Mar 84	8,6	96448	072829	Bonifer & Meacham Cr.	0,08	138 /6	87	51	0
83 B	995250	Jun 84	85.1	210441	073124	Uma,R,(RM 1,5) & Col,R,	0.77 /5	5108 /7	1554	3551	3
83 B	198162	Mar 85	7.8	88306	073121	Uma,R,(RM 87) & Bonifer	0.77 /5	1532	929	599	4
84 B	3223172	Jun 85	92,3	206156	073326	Umatilla R.(RM 1,5)	0.78	25239	10460	14732	47
84 B	51000	Oct 85	16,2	30838	073162	Bonifer	0.62	315	137	175	3
84 B	206815	Mar 86	4.8	88396	073327	Bonifer & Minthorn	2.82 /5	2571 /8	1512	1004	55
85 B	191432	Jun 86	86.0	20636	073833	Umatilla R.(RM 1.5)	0.43	851	325	526	0
85 B	198153	Jun 86	86,0	21335	013834	Umatilla R.(RM 1.5)	0,13	260	0	260	0
85 B	197488	Jun 86	86.0	20590	013835	Umatilla R,(RM 1,5)	0.15	296	124	172	0
85 B	196952	Jun 88	85.0	20170	073836	Umatilla R.(RM 1,5)	0.35	694	264	430	0
85 B	191788	Jun 88	86.0	20982	013837	Umatilla R,(RM 1.5)	0.17	330	160	170	0
85 B	208103	Jun 86	86.0	20815	013838	Umatilla R,(RM 1.5)	0.22	460	210	250	0
85 B	208958	Jun 86	86,0	21659	073839	Umatilla R.(RM 1,5)	0.37	782	193	589	0
85 B	207550	Jun 86	86.0	20259	073840	Umatilla R.(RM 1.5)	0.43	901	543	353	0
85 B	208184	Jun 86	86.0	20895	073841	Umatilla R.(RM 1.5)	0.20	419	70	349	0
85 B	208994	Jun 86	86.0	21694	073842	Umatilla R,(RM 1.5)	0.24	511	39	472	0
Total	2029602			209145			0.27	5504	1928	3576	0
85 B	22216	Mar 87	8.1	10103	073823	Minthorn	1.35 /5	299	163	110	26
85 B	22523	Mar 87	8.1	10243	073824	Minthorn	1.60 /5	360	213	132	15
85 B	21807	Mar 87	8.1	9917	073825	Minthorn	1.22 /5	266	132	99	35
85 B	20881	Mar 87	8,1	9496	013826	Minthorn	1.22 /5	255	132	97	26
85 B	21716	Mar 87	8.1	9876	013821	Minthorn	1.19 /5	259	147	81	31
Total	109143			49635			1.31	1439	787	519	133
85 B	20786	Mar 87	8.6	10253	073828	Bonifer	1.23	255	160	89	6
85 B	20212	Mar 87	8.6	9970	013829	Bonifer	1.33	269	184	81	4
85 B	20546	Mar 87	8.6	10135	013830	Bonifer	1.53 /5	314	158	144	12
85 B	20381	Mar 87	8.6	10053	073831	Bonifer	1.33	271	146	97	28
85 B	20438	Mar 87	8.6	10081	013832	Bonifer	1,18 /5	241	109	118	14
Total	102363			50492			1,31	1350	751	529	64

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Table 20, (cont.)

Br. Stock	Yr, Released	Number Released	Date of Release	Size at Release	Number Tagged	CWT Code	Release Location	%	Estimated Adult Survivals Total	Ocean	Col,R,	Uma,R,
86 P		497572	May 87	60.4	40793	073912	Umatilla R,(RM 1,5)	0.24	1171	378	756	37
86 P		501266	May 87	60.4	41096	073913	Umatilla R,(RM 1,5)	0.29	1452	781	659	12
86 P		477992	May 87	60.4	39187	073914	Umatilla R.(RM 1.5)	0,29	1366	659	585	122
Total		1478830			121078			0.27	3989	1818	2000	171
86 P		670	Jul 87	20,0	643	073915	Minthorn					
86 P		672	Jul 87	20.0	645	073916	Minthorn					
86 P		658	Jul 87	20,0	632	074035	Minthorn	0.63	4	0	4	0
Total		2000			1920			0,2	4	0	4	0
86 B		52317	Mar 88	8,8	42068	074038	Minthorn	0,33 /5	172	77	49	46
86 B		48474	Mar 88	8-8	38978	074039	Minthorn	0.26 /5	125	50	10	65
Total		100791			81046			0.29	297	127	59	111
86 B		50480	Apr 88	10,2	39509	074036	Bonifer	0035 /5	177	79	43	55
86 B		49070	Apr 88	10.2	38405	074037	Bonifer	0.27 /5	133	57	33	43
Total		99550			77914			0.31	310	136	76	98
87 P		1888757	May 88	68.3	198285	075007	Umatilla R,(RM 23)	0.01	190	57	38	95
87 P		4823	Nov 88	9,8	4438	074539	Minthorn					
87 P		4660	Nov 88	9,8	4289	074540	Minthorn					
87 P		4925	Nov 88	9.8	4533	074541	Minthorn					
Total		14408			13260			0	0	0	0	0
87 P		26858	Nov 88	8.6	24856	074536	Nr, Minthorn	0.01	2	0	0	2
87 P		25493	Nov 88	8.6	23403	074537	Nr. Mintborn	0.01	3	2	0	1
87 P		27330	Nov 88	8.6	25089	074538	Nr, Minthorn	0.01	2	0	0	2
Total		79681			73148			0.01	7	2	0	5

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/1 The adult returns from the 1984-87 brood are incomplete,
12 T = Tule stock
B = Bonneville upriver brights
P = Priest Rapids upriver brights
/3 The data reported in the table are expanded numbers.
/4 Approximately 48.7% of the fish were released at RM 1.5 and 51.3% at RM 51,5,
/5 Sub-jack recoveries were not used in estimating expanded survival nunbers,
/6 The expanded survival data is based on a release of 175,104 fish in Meachan Cr, (RM 30). It does not include 53,308 fish released at Bonifer (RM 2 of Meachan Cr,),
/7 The expanded survival data is based on a release of 667,190 fish in the Umatilla River (RM 1.5). It does not include 329,080 fish released at Rock Cr. State Park in the Columbia River.
/8 The expanded survival data is based on a release of 91,038 fish at Minthorn. It does not include 115,779 fish released at Bonifer,

fish. Fish were released near the mouth (RM 1.5), below all major diversions. Releases were made later in the season (June) than yearling releases (usually March and April) to get the fish to a larger size at release (85.1 to 92.3/1b.). Releases for which return information is available were made from 1984 to 1986 (1983-85 broods) (Table 20).

Survival of the 1984 and 1985 releases (through age-5 fish) is 0.77 and 0.78%, respectively. Survival of the 1986 releases through age-4 fish varies from 0.13 to 0.43% with an average of 0.27%. This is lower than the survival rates of the 1984 and 1985 releases through age-4 fish (0.68 and 0.55%, respectively).

All but one release of fish in the upper river were yearlings. The fish were released from Minthorn (RM 63) up to RM 87 on the Umatilla River and up to RM 30 of Meacham Creek (28 RM above Bonifer and 109 RM from the mouth of the Umatilla River). Two releases were made in April, while all others were made in March. Subyearlings were reared at Bonifer over the summer and released in October. The yearling fish ranged from 4.8 to 10.2/lb. at release from 1983 to 1988. The subyearling fish released in October were 16.2,'lb.

The survival (through age-5 fish) of the yearling releases (1983 to 1986) varied from 0.08 to 2.82% (Table 20). Early releases made in 1983 and 1984 survived poorly (0.16 and 0.08 %, respectively). Survival increased to 0.77% for 1985 releases and 2.82% for 1986 releases. Through age-4 fish, the survival rate is 1.31 % for all groups released in 1987 from acclimation facilities. In comparison, the survival of the 1986 releases through age-4 fish was 2.08%. Preliminary recovery information for age-3 fish suggests similar or better survival for fish released in 1988 as in 1987.

Survival of the subyearling fish released in October of 1985 was 0.62%. This is lower than the survival from the same brood released near the mouth in June (0.78%), and much lower than the survival of the fish held longer at the hatchery and released the following March (2.82%).

Data from early releases (1984 brood and earlier) show that most of these fish were recovered as age-4 fish, similar to results from this stock released elsewhere (Howell et. al. 1985). A similar trend seems to be occurring for the 1985 brood (1989 recoveries), but data on age-5 fish are not available.

Exploitation of adults of the Bonneville stock of upriver bright fish (all releases) was 92.4%. Although the overall average exploitation rate (unweighted for size of release group) was the same for releases of yearlings (92.5%) as for releases of subyearlings (92.3%), distribution of the catch differed. Adults from subyearling releases were recovered most frequently in the Columbia River gillnet fishery (59.0% versus 30.9% in the ocean

commercial fishery), whereas adults from yearling releases were recovered most often in the ocean commercial catch (42.9% versus 33.7% in the Columbia River gillnet fishery). Sport catch averaged 2.2% of the recoveries of adults from subyearling releases and 13.4% of adults from yearling releases. Likewise, 0.2% of the recoveries of adults from subyearling releases were from the treaty fisheries, while 2.5% were from adults from the yearling releases. Because the number of CWT codes for subyearlings is heavily represented in the 1986 releases, this may be an artifact of recovery year rather than size at release. The experiments have not been designed to test this.

Fall - Priest Rapids stock

Beginning with releases in 1987, upriver bright stock of upriver origin was available for release in the Umatilla River. These juveniles were from adults returning to Priest Rapids Dam (1986 brood).

Preliminary recovery information (through age-3 fish) shows subyearlings released in May of 1987 near the mouth of the Umatilla River are returning at higher rates (0.24 to 0.29%) than the Bonneville stock did at the same age (0.03 to 0.27%) (Table 20). The Priest Rapids stock however, were released at a larger size (60.4/lb. versus 85.1 to 92.3/1b. for the Bonneville stock) and they were released in May instead of June.

Both production and acclimation releases also occurred in 1988 and 1989 (Table 20). A few fish have been recovered from the releases made in 1988. Long-term data comparing the two upriver stocks are not yet available. Releases in a controlled experiment comparing the two stocks under similar treatments have never been done. It has been assumed that upriver bright stocks are better adapted to return farther upstream than lower river stocks, and fish from Priest Rapids stock are being used whenever available. Recoveries are too preliminary to estimate modal year of recapture or exploitation trends.

Spring Chinook

The first coded-wire tagged releases of yearling spring chinook in the Umatilla River were in 1988 from Carson via Lookingglass stock (Table 21). Two groups were released in April (one group from Bonifer pond and one group between Rm 23 and 69 of the Umatilla River), and two groups were released in November (one group from Bonifer pond and one group into Meacham Creek). The purpose of the experiment was to evaluate acclimation. Several problems were encountered in both the spring and fall experiments (Lofy, 1988). These problems essentially eliminate any possible comparison between acclimated and non-acclimated fish.

The survival rates through age-3 fish for both spring release

Table 21, Liberation and survival information for spring chinook salmon released in the Umatilla River. /1

Brood	Number Released	Date of Release	Size at Release	Number Tagged	CUT Code	Release Location	Estimated Adult Survival to Oregon %	Total	Hatchery	Fish Trap
86	35946	Nar-Apr 88	10,l	26640	014325	Bonifer	0.023	8	3	5
86	35148	Mar-Apr 88	10,l	25863	074326	Bonifer	0,012	4	0	4
86	35139	Nar-Apr 88	10.1	25853	074327	Bonifer	0,008	3	0	3
Total	106231			18356			0,014	15	3	12
86	34187	Apr 88	8.7	26319	074328	Uma,R, (RM 23-69)	0,015	5	1	4
86	33513	Apr 88	8.7	25122	074329	Uma.R. (RM 23-69)	0.023	8	3	5
86	34118	Apr 88	8.1	26252	074330	Uma.R. (RM 23-69)	0,008	3	0	3
Total	101878			78293			0,015	16	4	12
87	416	Nov 88	21,4	410	014420	Bonifer				
87	399	Nov 88	21,4	393	074423	Bonifer				
87	381	Nov 88	21,4	376	074424	Bonifer				
Total	1196			1119			0	0	0	0
87	26109	Nov 88	11.1	25981	074427	Meacham Cr ,				
87	24183	Nov 88	11,l	24010	074429	Meachar Cr,	0,008	2	0	2
87	25415	Nov 88	11,l	25356	074430	Meachar Cr,				
Total	75767			75413			0,002	2	0	2

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/1 The survival data includes age-2 and age3- fish only (1988 adh 1989 returns),

groups are similar (0.014 and 0.015%). Approximately 77.4% of the fish were recovered at Threemile Falls Dam on the Umatilla River and 22.6% were recovered at Oregon hatcheries. The only recoveries from the fall releases through 1989 are age-2 fish and only two were recovered at Threemile Falls Dam.

Coho

Coded-wire tagged yearling coho salmon have been released into the Umatilla River since 1987 (Table 22). These fish have been from Tanner Creek stock reared at Cascade Hatchery.

The first release was from Minthorn in April, 1987. The average survival rate was **1.66%.** The highest percentage of recoveries was in the ocean (62.2%), while recoveries in the Columbia River and Umatilla River were 34.6 and 3.2%, respectively. Exploitation of this release was 95.0%. Exploitation rates in the commercial ocean and Columbia River gillnet fisheries were 39.2 and 26.6%, respectively. The sport fishery accounted for 29.2% of the catch while no fish were captured in the treaty fishery.

The second release of coded-wire tagged coho were in the lower Umatilla River in March, 1988 (Table 22). These fish were smaller than the fish released in 1987, but average adult recoveries were much higher (4.05%). The ocean recovery rate (64.7%) was similar to the 1987 release. The recovery rates in the Columbia and Umatilla rivers differed however (19.6 and 15.7%, respectively). Exploitation of this release was 83.5%. Exploitaion rates in the commercial ocean and Columbia River gillnet fisheries were 31.9 and 18.1%, respectively. The exploitation rates in the sport and treaty fisheries were 31.3 and 2.2%, respectively.

Two groups of coho were released in 1989 (Table 22). One group was acclimated at Minthorn and a second group was released into the Umatilla River at the same time as the acclimated release. The recovery of age-2 fish was higher than age-2 recoveries for the 1987 releases, but lowerthanthe recoveries for the 1988 releases. The recovery of age-2 fish for the acclimated group was 0.05%, while the recovery for the non-acclimated group was 0.03%. Nearly all of the age-2 recoveries (94.3%) were at Threemile Dam on the Umatilla River. An estimated six fish were captured in the ocean sport fishery, while none where observed captured in the Columbia River.

Project Difficulties

Operational problems at Bonifer

Complete drainage of the pond was a problem again in the spring of this year. Yearly bedload movement from destabilized banks caused by the flood of February of 1986 continued to fill in the area surrounding the outlet at Bonifer. The work completed

Table 22, Liberation and survival information for coho salmon released in the Uaatilla River, /1

Brood	Number Released	Date of Release	Size at Release	Nuaber Tagged	CWT Code	Release Location	Estimated Adult Survivals %	Total	Ocean	Col.R,	Uma.R.
85	37245	Apr 87	13,5	13440	073617	Minthorn	1.94	723	424	263	36
85	53754	Apr 87	13,5	19879	073624	Minthorn	1.66	890	552	314	24
85	70890	Apr 87	13,5	26740	073625	Minthorn	1,51	1075	695	353	27
Total	161889			60059			1.66	2688	1671	930	87
86	68208	Mar 88	16.8	20592	074356	Lower Umatilla R.	4.16	2838	1785	672	381
86	73650	Mar 88	17.3	19038	074357	Lower Umatilla R.	3.99	2937	1927	511	499
86	61606	Nar 88	15,7	18588	074358	Lower Uaatilla R,	4.03	2483	1631	434	418
Total	203464			58218			4.05	8258	5343	1617	1298
87	75970	Mar 89	17,2	27062	074609	Nr, Minthorn	0.03	20	0	0	20
87	72627	Mar 89	17.3	26416	074610	Minthorn	0,05	36	0	0	36
87	84672	Mar 89	19.1	26739	074611	Minthorn	0,06	50	6	0	44
Total	157299			53155			0,05	86	6	0	80

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/l Survival data for the 1987 brood includes age-2 fish only (1989 returna).

under the BPA-funded Habitat Improvement Project in Boston Canyon Creek has removed much of the material that was deposited at the outlet of Bonifer and under the railroad track bridge. A log weir placed just upstream of Bonifer outlet is expected to keep the outlet relatively clear, although yearly maintenance is expected to be necessary. Although a "barrier" (cobble dam) across the spring entrance remained intact, fish were seen in the ponds above the entrance of the main spring. Temporary weirs were installed at the inlet to the pond from each of the weirs. The structure at the largest spring has been built so that it can be used to provide a more effective barrier to migrating fish. Several methods will be considered in 1990.

Although acclimation at Bonifer in the fall was shortened from a 21-day acclimation period down to three days, and a portion of the aquatic vegetation was removed prior to acclimation, dissolved oxygen was again a problem. Dissolved oxygen at the outlet was above 7.0 ppm and above 8.0 ppm at the inflow of the largest spring. Flow out of the outlet (not a good estimate of total flow into the pond, but a fair index of changes in flow) was increasing and water quality conditions seemed to be improving. Conditions for acclimation appeared acceptable, although not ideal. Dissolved oxygen dropped dramatically immediately after the fish were placed in the pond. An increase in oxygen demand (due to the fish) and a decrease in DO of water coming into the pond (DO at the inflow of the largest spring dropped from 9.8 to 6.0) caused DO to drop in the pond. Dissolved oxygen at the outlet dropped as low as 4.6, although DO in the middle of the pond was higher (6.2 to 6.8). The pond could not sustain a DO above 7.0. Although DO appeared to have been high during the regularly-scheduled acclimation period (early to late September), very low flows in late August through the middle of September suggest that inflow of spring water may not have been enough to sustain a DO above 7.0 ppm had there been fish in the pond.

Operational problems at Minthorn

A low water supply forced recirculation of water again this year at Minthorn. All water was recycled into the intake pond because DO of water directly from the spring had a lower DO than that exiting the raceway. Bottled oxygen was used during the night to assure that during the early hours of the morning the DO did not get dangerously low. Dissolved oxygen of the spring water was as low as 5.0 ppm. Recycling of water that was aerated during the plunge at the inflow and again through the grates at the outflow along with backup oxygen kept the DO at least 7.0 ppm at the head of the raceways and at least 6.0 ppm at each outlet.

Research problems

Extensive aquatic macrophyte growth in the summer made retrieval of mortalities difficult in the fall. Definitive

information on the outmigration of particular releases has been impossible to determine. Multiple releases make it difficult to distinguish between acclimation groups, test and control groups and subspecies (chinook salmon of similar sizes). Until fish can be differentially marked, groups will not be distinguishable downstream in the Umatilla River basin or in the mainstem Columbia River. Until efficiencies for trapping facilities can be determined, outmigration of juveniles from the Umatilla River basin can not be estimated with any accuracy.

SUMMARY OF EXPENDITURES

Expenditures for activities associated with the operation, maintenance and evaluation of Bonifer and Minthorn Acclimation Facilities in 1989 totaled $239,940.67. Most expenditures were for personnel and subcontract to coded-wire tag fish (Table 23).

Table 23. Expenditures for Bonifer and Minthorn Facilities operation, maintenance and evaluation - 1989.

Line Item	Expenditure
Personnel	70,771.88
Travel (all)	2,474.84
Fish Food	3,058.OO
Property Lease	226.83
Facility Use Fees	1,332.OO
Electricity/utilities (Minthorn)	1,500.00
Materials and Supplies	7,216.54
Communications (telephone/alarm)	2,497.64
Repairs & Maintenance (equipment servicing)	836.89
Printing/Duplication	898.54
Equipment Rental (GSA mileage, rental & insurance)	9,201.49
Equipment Rental - General	454.95
SUBTOTAL:	$100,469.60
Indirect	30,731.80
Nonexpendables (Capital Equipment)*	15,755.63
Sub-Contract	92,983.64
TOTAL:	$239,940.67

* Nonexpendables		
	Port-A-Gram Scale	401.83
	Trimmer/Bushcutter	319.96
	Field Sampling Detector	2,943.50
	Portable Pressure Washer	1,495.oo
	Microhematocrit Centrifuge	969.00
	Microcapillary Tube Reader	160.00
	Tempmentors & cases (4)	3,011.21
	Communicator/Auto Dialer	450.00
	Vehicle Radios	2,550.OO
	Typewriter	490.00
	Printer	925.97
	Computer/Printer Stand	174.07
	Computer/Printer Stand Chair	244.00
	Desk Chair	244.00
	File Cabinets (4)	371.76
	Table Saw	489.00
	Desk	516.33
	Total:	$15,755.63

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APPENDICES

Appendix A, Steelhead braodstock spawning and aortality at Uinthorn and Threesile Dan - 1989.

Family	Sex	Co11 #	Hark l/	Date co11	Fork length (mm)	Hypural length (mm) 2/	Height (lbs)3/	Fecundity 4/ egg loss	eyed eggs	total eggs	Date spawned	Prespawn nortalitp M	F	Tot
1	P	1	LL	l/19	**	460	3,l	104	6,664	6) 768	4-5-89	0	0	0
	M	2	LL	l/19	660	520								
2	P	3	LL	l/19	770	640	6.6	5,386	4,134	9,520				
	M	4	LL	l/19	680	550								
3	F	5	LL	l/19	**	560	5.8	413	3,150	3,563				
	M	6	UR	3/3&10	770	600								
4	P	7	LL	l/19	680	540	6,4	1,904	1,800	3,104				
	M	8	LL	l/19	120	560								
5	F	9	LL	l/19	140	600	6.7	1,311	2,244	3,561				
	M	10	LR	3/27	560	440	-							
6	P	11	UL	12/9	620	510	4,2	808	6,948	7,756				
	M	12	LL	l/19	590	470								
7	F	13	UL	12/9	720	590	5,8	115	5,616	5,131				
	M	14	UL	12/9	740	580								
8	F	15	LL	l/19	580	470	3,7	1,030	0	1,030				
	M	16	LR	3/27	750	610								
9	P	17	UR	3/3&10	**	570	5,6	219	6,120	6,399				
	M	18	UR	3/3&10	650	520								
10	F	19	LL	l/19	720	590	6,l	344	4,112	5,056				
	M	20	UR	3/3&10	750	590								
11	P	21	UR	3/3&10	740	600	6.4	292	4,486	4,780				
	M	22	UR	3/10&10	710	510								
12	F	23	UL	12/9	730	610	6,2	312	1,337	1,649				
	M	24	LL	l/19	730	580								
13	F	25	UL	12/9	630	510	4,7	84	4,224	4,308				
	M	26	LL	l/19	580	470								
14	F	27	UL	12/9	600	490	4,0	17	4,046	4,063				
	M	28	UR	3/3&10	750	600								
15	F	29	LL	l/19	590	490	4,l	115	4,801	4,922				
	M	30	LL	l/19	700	560								
16	F	31	UL	12/9	560	460	3,9	50	6,048	6,098				
	M	32	LR	3/27	700	570								
17	F	33	LR	3/27	**	590	6.0	1,666	5,236	6,902	4-12-89	3	2	5
	H	34	UL	12/9	590	470								
18	F	35	LR	3/27	570	490	3,4	304	3,648	3,952				
	M	36	LR	3/27	630	500								
19	F	37	LL	l/19	670	550	4.8	204	5,100	5,304				
	M	38	LL	l/19	620	500								
20	F	39	UR	3/3&10	**	550	4.9	205	5,566	5,771				
	M	40	LR	3/27	590	470								
21	P	41	LR	3/27	550	450	2.6	238	2,770	3,008				
	M	42	UR	3/3&10	**	570								

Appendix A, (cont.)

Family	Sex	Coll #	Mark 1/	Date coll	Fork length (mm)	Hypural length (mm)	Weight 2/ (lbs)3/	Fecundity 4/ egg lose	eyed eggs	total eggs	Date spawned	Prespawn mortality M	F	Tot
22	F	43	UR	3/3&10	**	590	6.2	1,032	5,180	6,212	4-21-89	12	13	25
	M	44	UL	12/9	**	460						"extra" STS released		
23	F	45	LR	3/27	**	590	6.0	3,391	3,700	7,091				
	M	46	LL	1/19	**	600								
24	F	47	UL	12/9	**	540	4.2	694	2,775	3,469				
	M	48	LR	3/27	**	580								
25	F	49	UL	12/9	**	630	1.1	612	7,956	8,568				
	M	50	UR	3/3&10	**	600								
26	F	51	UR	3/3&10	**	650	7.4	442	8,096	8,538				
	M	52	UR	3/3&10	**	610								
27	F	53	LL	1/19	**	470	3.5	***	***	3,808				
	M	54	LR	3/27	**	500	-							
28	F	55	LR	3/27	**	550	4,2	169	7,200	7,369				
	M	56	UR	3/3&10	**	640								
29	F	57	LL	1/19	**	580	5.7	462	6,864	7,326				
	M	58	LL	1/19	**	590								
30	F	59	LL	1/19	**	455	2,7	65	4,155	4,220				
	M	60	LL	1/19	**	505								
31	F	61	UR	3/3&10	**	600	6,6	185	4,440	4,625				
	M	62	UR	3/3&10	**	520								
32	F	63	UL	12/9	**	575	5.0	238	6,902	7,140				
	M	64	LR	3/27	**	480								
33	F	65	UR	3/3&10	**	485	3.1	***	***	7,237				
	M	66	UL	12/9	**	470								
34	F	67	LL	1/19	**	450	3.2	3,825	3,315	7,200				
	M	68	UL	12/9	**	480								
35	F	69	UL	12/9	**	595	5,5	216	4,320	4,536				
	M	70	LL	1/19	**	470								
36	F	71	LL	1/19	**	580	5,9	49	4,050	4,099				
	M	72	LL	1/19	**	470	-							
37	F	73	LR	3127	**	590	6.5	85	1,344	7,429				
	M	74	UL	12/9	**	500								
38	F	75	N/A	N/A		440	-	206	6,562	6,768	4-28-89	-	-	-
	M	76	N/A	N/A		580	-							
39	F	77	N/A	N/A				***	***	5,307				
	M	78	N/A	N/A										
40	F	79	N/A	N/A	740	620	-	***	***	6,660	5-3-89	-	-	-
	N	80	N/A	N/A	720	580	-							
41	F	81	N/A	N/A	580	490	-	***	***	4,427				
	M	82	N/A	N/A	610	490	-							
42	F	83	N/A	N/A	580	460	-	***	***	3,808				
	M	84	N/A	N/A	**	395	-							

Appendix A, (cont.)

All	241,662	Preepawn	15 NM = 22%
Mean	5,154	mortality	15 FF = 18%
		Overall	30/150 = 20%

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1/ Marks: UL = upper left opercle
LL = lower left opercle
UR = upper right opercle
LR = lower right opercle

2/ Hypural length : riddle of the eye socket to distal end of the hypural bones.
3/ Weights are poet-epauning,
4/ Fecundity determined by ODFW, Irrigon Hatchery.
** It was not poaeible to take fork length8 on these fish because of eroded caudal fins,
*** Data were not recorded, Deetroyed -- IRNV suspect eggs,
N/A Not applicable - spawned at Threerile Dam Trap,

NOTES :

Deatroyed 29,900 eyed egg8 selected across family groups (program excess).
Shipped 151,000 eyed eggs selected across family groups to Oa lKSprings Hatchery,

Appendix B. Summary of hourly temperature data at Minthorn Acclimation Facility - 1989.

	JANUARY				FEBRUARY			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX,	AVE.	MED.
1	7.8	8.6	8.1	8.1	4.7	6.6	6.0	6.2
2	8.1	9.1	8.6	8.6	3.9	5.3	4.4	4.5
3	8.9	10.1	9.4	9.4	2.9	4.1	3.6	3.5
4	8.1	9.2	8.7	8.8	2.9	4.2	3.4	3.3
5	7.7	8.6	8.1	8.3	2.8	4.3	3.5	3.4
6	7.2	7.8	7.5	7.7	3.1	4.8	3.8	3.7
7	6.7	7.7	7.3	7.4	3.1	4.8	3.9	3.8
8	6.6	7.9	7.2	7.0	2.9	5.1	3.8	3.8
9	7.9	8.7	8.4	8.2	3.1	5.1	4.1	3.8
10	5.2	8.9	7.0	7.4	4.9	6.4	5.5	5.4
11	6.7	8.0	7.3	7.1	4.8	6.7	5.7	5.6
12	7.8	8.9	8.2	8.3	5.6	6.8	6.1	6.1
13	6.7	7.8	7.2	7.3	5.6	6.8	6.1	6.2
14	6.9	8.0	7.5	7.5	5.5	6.8	6.0	6.0
15	7.5	8.1	7.9	7.8	4.3	7.1	5.6	5.2
16	8.2	9.0	8.6	8.6	5.4	6.4	5.9	5.8
17	8.2	9.5	8.8	8.7	5.4	6.2	5.7	5.7
18	8.1	9.2	8.7	8.7	4.7	6.4	5.6	5.4
19	7.5	9.1	8.3	8.3	5.1	7.6	6.2	5.9
20	7.4	8.6	8.0	7.9	6.2	8.4	7.0	6.8
21	7.9	8.5	8.2	8.3	5.7	6.7	6.1	6.1
22	6.9	8.1	7.6	7.7	5.9	6.5	6.2	6.2
23	6.0	7.4	6.7	6.8	5.3	8.7	6.8	6.6
24	5.2	7.1	6.2	6.0	6.0	8.6	7.1	7.1
25	6.4	7.9	7.1	7.0	5.6	8.6	6.9	6.7
26	6.0	7.1	6.5	6.6	6.4	8.1	7.1	7.2
27	6.5	8.1	7.2	7.2	5.6	7.2	6.4	6.2
28	6.5	7.7	7.0	7.2	6.4	8.3	7.1	7.0
29	6.6	8.9	7.8	7.4				
30	7.4	8.8	8.1	8.4				
31	3.3	8.1	7.3	7.8				
Total	3.3	10.1	7.7	7.8	2.8	8.7	5.6	5.9

Revised: 07-12-90 File Name: D:\123R2\DATA\MNTM892

Note: Temperatures are in degrees Celsius.

Appendix B (cont.)

	MARCH				APRIL			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	4.6	6.5	5.8	5.9	6.4	8.8	7.6	7.8
2	4.2	6.3	5.0	5.3	6.4	8.9	7.6	7.7
3	4.1	7.2	5.4	5.7	6.6	9.6	7.9	7.7
4	4.0	6.1	5.1	5.1	6.7	9.1	7.9	8.3
5	5.2	6.5	5.9	5.9	7.3	9.9	8.6	8.7
6	6.4	9.2	7.6	7.8	7.8	11.6	9.6	9.5
7	6.6	9.1	7.6	7.9	8.0	11.5	9.5	8.5
8	6.3	8.0	7.1	7.2	5.8	10.3	8.0	8.1
9	6.9	8.1	7.5	7.6	6.5	11.4	8.8	8.8
10	5.2	8.5	6.9	6.9	7.3	10.0	8.2	8.0
11	6.3	9.2	7.5	7.8	6.6	12.1	9.2	9.1
12	4.9	8.3	6.7	6.6	7.2	12.2	9.6	9.5
13	6.3	7.5	6.9	7.0	7.5	12.7	9.9	9.8
14	6.0	7.5	6.6	6.7	8.1	11.7	9.9	9.8
15	5.9	8.6	7.1	7.3	8.5	10.5	9.3	8.8
16	6.0	6.9	6.5	6.5	7.5	12.1	9.6	9.6
17	5.6	9.2	7.2	7.4	8.1	12.2	10.0	9.5
18	6.7	8.3	7.5	7.5	7.8	13.0	10.2	10.2
19	6.6	9.2	7.7	7.9	8.1	12.8	10.4	10.1
20	5.8	10.2	7.8	8.0	8.1	13.2	10.5	10.4
21	7.2	9.1	8.0	8.1	8.7	11.1	9.6	9.0
22	6.5	9.0	7.5	7.7	8.0	11.7	9.7	9.3
23	6.6	10.5	8.1	8.5	7.7	12.7	10.1	10.1
24	6.4	9.2	7.6	7.9	8.1	10.4	9.3	9.2
25	7.2	8.9	8.0	8.1	8.5	9.5	8.9	8.6
26	6.3	9.8	7.9	8.1	8.1	10.3	9.1	9.3
27	2	9.2	8.1	8.2	8.5	12.2	10.2	10.1
28	7.2	10.4	8.4	8.8	8.6	11.3	9.8	9.5
29	6.8	9.6	7.9	8.2	7.8	13.5	10.5	10.7
30	5.9	9.2	7.6	7.4	8.1	14.1	11.1	11.4
31	7.1	10.2	8.3	8.7				
Total	4.0	10.5	7.2	7.6	5.8	14.1	9.3	9.3

Appendix B (cont.)

	MAY				JUNE			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	9.6	12.0	10.6	10.4	11.2	16.4	13.8	13.8
2	9.1	12.8	10.8	10.9	11.8	16.3	13.9	13.8
3	8.7	13.6	11.1	11.5	11.9	15.6	13.7	13.5
4	9.1	14.2	11.6	11.9	11.5	15.6	13.5	14.0
5	9.5	13.9	11.6	11.9	11.9	16.1	13.9	14.5
6	10.1	13.9	11.8	12.0	12.4	16.2	14.2	14.1
7	10.3	14.7	12.3	12.5	11.5	15.7	13.5	13.9
8	9.8	14.8	12.1	12.5	11.8	16.2	13.8	14.2
9	10.0	12.8	11.2	11.2	12.0	16.3	13.8	13.7
10	9.5	11.3	10.2	10.0	11.4	16.0	13.7	13.9
11	8.8	12.6	10.5	10.7	11.7	16.9	14.2	14.4
12	8.5	12.8	10.7	11.2	12.2	16.5	14.3	14.4
13	8.5	13.9	11.2	11.7	12.5	14.4	13.5	13.2
14	9.6	14.1	11.7	11.9	12.0	15.5	13.5	13.8
15	9.2	14.4	11.8	12.3	11.4	13.6	12.6	11.5
16	9.8	13.1	11.5	11.7	10.3	16.0	13.0	13.4
17	9.9	13.0	11.3	11.7	11.3	15.1	12.9	13.0
18	9.0	11.4	10.3	10.3	11.4	17.4	14.2	14.6
19	8.4	13.4	10.7	11.1	12.4	14.8	13.6	12.9
20	8.8	13.8	11.4	11.9	11.1	16.0	13.4	13.6
21	9.5	13.5	11.5	12.0	11.4	17.0	14.1	14.5
22	10.2	13.3	11.7	11.9	12.7	15.3	13.7	13.2
23	10.0	12.4	11.1	11.0	11.3	17.6	14.3	14.7
24	9.5	12.3	10.7	10.6	12.5	18.2	15.0	14.8
25	9.6	13.6	11.5	11.7	12.5	18.0	15.1	15.2
26	9.8	12.0	11.1	11.5	13.3	17.5	15.2	14.2
27	9.9	11.3	10.6	10.3	11.9	14.6	13.2	13.0
28	8.8	12.8	10.8	11.2	11.6	14.5	13.0	13.2
29	10.0	11.4	10.6	10.4	12.1	16.7	14.0	14.5
30	9.1	14.5	11.9	12.6	12.8	16.0	14.4	14.0
31	10.5	15.6	13.0	13.5				
Total	8.4	15.6	11.2	11.7	10.3	18.2	13.8	13.9

Appendix B (cont.)

	JULY				AUGUST			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	12.1	13.4	12.8	12.8	13.1	16.0	14.5	14.5
2	11.6	17.4	14.1	15.1	13.3	16.0	14.5	14.1
3	12.5	17.6	14.8	15.6	13.6	15.8	14.5	14.4
4	12.6	17.5	14.8	15.7	12.6	16.7	14.4	13.7
5	12.6	17.4	14.9	15.6	13.1	16.8	14.7	14.6
6	12.4	17.8	14.9	15.6	13.6	16.4	14.7	15.0
7	12.9	18.0	15.2	15.9	14.5	16.6	15.5	15.8
8	12.8	17.2	14.8	15.2	14.8	17.2	16.1	16.1
9	12.3	16.7	14.2	14.1	14.7	16.4	15.4	15.8
10	12.5	17.1	14.6	14.8	13.9	16.1	14.7	15.5
11	12.6	17.1	14.8	15.3	13.6	15.4	14.4	14.8
12	13.3	15.6	14.4	13.7	13.6	15.3	14.3	14.7
13	13.3	18.3	15.9	17.1	13.4	15.5	14.3	14.5
14	13.9	16.8	15.4	15.4	13.1	15.3	14.0	14.6
15	13.3	16.2	14.6	14.1	13.1	16.5	14.8	14.1
16	12.6	14.9	13.5	13.0	12.3	16.4	14.1	13.2
17	13.0	17.7	15.1	15.6	12.8	16.2	14.3	13.8
18	13.6	17.7	15.4	15.0	13.0	17.1	15.0	13.9
19	14.0	17.8	15.7	15.5	13.7	16.8	15.2	14.5
20	13.9	17.3	15.5	15.4	14.1	17.6	15.7	14.8
21	13.1	16.8	[illegible].8	14.2	14.3	16.0	15.1	15.0
22	12.7	16.7	14.5	13.8	14.0	15.2	14.6	14.6
23	13.1	16.7	14.6	13.9	12.8	13.9	13.1	13.4
24	13.4	16.5	14.7	14.0	12.6	13.9	13.2	12.8
25	12.7	16.8	14.9	14.9	13.0	16.2	14.3	13.2
26	13.2	16.1	14.6	13.7	13.1	16.6	14.7	13.8
27	13.3	17.0	15.0	14.5	13.4	16.7	15.0	14.3
28	12.6	16.8	14.6	13.9	13.3	16.8	15.0	14.1
29	13.0	16.9	14.7	14.0	13.4	15.6	14.6	14.3
30	13.3	17.0	15.0	14.1	13.4	15.2	14.2	14.0
31	13.0	17.1	15.1	15.9	13.0	16.0	14.3	13.7
Total	11.6	18.3	14.8	14.9	12.3	17.6	14.6	14.4

Appendix B (cont.)

	SEPTEMBER				OCTOBER			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	12.8	14.9	13.9	14.0	11.6	13.4	12.6	12.7
2	13.0	14.7	13.7	13.6	11.3	13.4	12.3	11.9
3	12.2	15.5	13.7	13.2	9.7	12.3	9.9	11.0
4	12.5	15.5	13.9	13.5	9.7	12.7	11.2	11.4
5	13.4	16.5	14.5	14.1	11.1	13.3	12.2	12.2
6	12.4	15.2	13.7	13.5	10.9	13.5	12.1	12.0
7	12.1	15.0	13.4	13.0	10.6	13.4	12.0	12.2
8	12.6	15.2	13.7	13.5	11.1	14.1	12.6	12.6
9	12.6	15.0	13.7	13.7	11.1	13.9	12.5	12.4
10	11.8	14.4	13.1	12.9	11.1	13.9	12.6	12.8
11	11.6	14.0	12.7	12.7	11.8	12.8	12.4	12.1
12	11.3	14.2	12.6	12.3	11.2	12.6	11.9	11.8
13	11.7	14.5	13.0	12.7	11.3	12.5	11.9	12.0
14	12.1	14.8	13.3	13.0	11.0	13.1	12.1	11.6
15	12.7	1.2	13.8	13.4	9.1	11.1	10.1	9.9
16	12.7	i4.4	13.5	13.5	8.1	10.9	9.6	9.6
17	12.8	13.7	13.1	13.5	8.4	11.1	9.7	9.8
18	12.2	14.3	13.1	12.7	8.8	11.6	10.2	10.4
19	11.8	14.1	12.8	12.7	10.0	10.8	10.4	10.4
20	11.6	14.1	12.7	12.5	11.4	11.9	11.7	11.8
21	11.6	14.1	12.8	12.5	11.6	12.2	11.9	11.9
22	11.9	14.4	13.1	12.8	11.0	11.6	11.3	11.4
23	12.1	14.6	13.3	13.0	11.2	12.4	11.8	11.6
24	12.6	15.0	13.7	13.2	9.7	11.6	10.8	10.7
25	12.9	14.6	13.7	13.5	10.3	11.6	10.8	10.7
26	12.8	14.5	13.6	13.7	9.5	10.8	10.2	10.4
27	11.7	14.9	13.4	12.8	10.3	11.1	10.6	10.4
28	12.1	15.2	13.5	12.8	9.2	11.1	10.1	9.7
29	12.3	15.0	13.7	13.1	7.8	10.2	8.9	8.6
30	12.6	13.9	13.3	13.7	7.7	10.2	8.9	9.0
31					8.6	10.5	9.5	8.9
Total	11.3	16.5	13.4	13.2	7.7	14.1	11.1	11.4

Appendix B (cont.)

	NOVEMBER				DECEMBER			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	7.4	9.6	8.5	8.5	7.4	7.8	7.5	7.6
2	7.1	9.6	8.4	8.0	7.2	7.6	7.4	7.5
3	9.2	11.3	10.3	9.5	7.2	8.3	7.7	7.7
4	10.5	11.4	10.9	10.8	8.4	10.5	9.6	9.8
5	10.0	11.0	10.4	10.4	9.6	10.4	10.0	10.0
6	9.6	10.0	9.8	9.9	9.1	10.2	9.6	9.9
7	9.2	10.3	9.8	9.8	8.4	9.3	8.7	8.6
8	9.2	10.3	9.7	9.5	8.5	10.0	9.2	9.2
9	10.3	12.3	11.3	10.5	8.1	9.2	8.6	8.6
10	11.0	12.1	11.5	11.9	7.5	8.8	8.2	8.2
11	10.0	11.3	10.7	10.8	6.3	7.4	6.8	6.7
12	10.5	10.9	10.8	10.8	5.7	6.9	6.3	6.3
13	9.8	10.5	10.1	10.4	5.5	6.7	6.1	6.1
14	8.7	9.7	9.2	9.4	5.8	7.0	6.4	6.4
15	7.8	9.2	8.4	8.8	6.4	6.8	6.6	6.6
16	8.1	9.8	9.0	8.8	6.4	6.8	6.6	6.5
17	9.5	9.9	9.6	9.8	6.3	6.7	6.5	6.5
18	9.1	10.2	9.6	9.5	6.1	6.8	6.5	6.7
19	9.7	10.9	10.2	10.1	6.5	7.8	7.0	7.0
20	9.5	10.5	10.1	10.4	6.7	8.0	7.3	7.4
21	9.8	10.8	10.2	10.3	6.9	7.8	7.3	7.3
22	8.4	9.5	8.8	9.4	6.4	6.9	6.6	6.6
23	8.6	9.7	9.1	8.7	6.6	8.1	7.2	7.2
24	8.7	9.4	9.0	9.2	6.9	7.3	7.1	7.0
25	8.4	9.1	8.8	8.8	6.5	6.9	6.7	6.7
26	8.5	9.2	8.9	9.0	6.2	6.7	6.4	6.4
27	7.6	8.8	8.2	8.3	6.0	6.4	6.2	6.2
28	7.3	8.5	7.9	8.0	5.5	6.7	6.1	6.2
29	7.1	7.8	7.5	7.7	5.2	6.5	5.7	5.8
30	7.3	7.9	7.6	7.5	5.3	6.2	5.6	5.7
31					5.7	6.4	5.9	6.0
Total	7.1	12.3	9.5	9.5	5.2	10.5	7.2	6.7

Appendix C. Dissolved oxygen, temperature and flow data for Minthorn Acclimation Facility in 1989.

Date	Minthorn Intake DO 1/	Minthorn Intake Tmp 2/	Proposed Intake DO	Proposed Intake Tmp 3/	Lower Head DO	Rway Outlet DO 4/	Upper Head DO	Rway Outlet DO	Just above Intake DO	Time	Water over weir 5/ (gpm)	Water through facility 6/ (gpm)	TOTAL (gpm)
1 / 5	8.2	11								0935	1,151		1,151
1 /12	7.7	9								0815	2,384		2,384
1 /19		9								1140	2,115		2,115
1 /26	8.2	6								1155	1,856		1,856
2 / 2		4								1235	2,665		2,665
2 /10		5								0820	1,856		1,856
2 /16	6.2	6								1210			
2 /23	6.8	8								1305	2,384		2,384
3 / 3	1.0	4								0930	656	1,520	2,176
3 / 8 F		7			8.6	7.8				0835		1,560	
							8.8	7.0		1635			
3 / 9 F		6			9.8	8.4	9.0	8.0		0830		1,500	
					9.6	8.4	9.2	8.0		1417			
3 /10 F		6			9.7	8.4	9.6	8.4		0917	5,611	1,520	7,131
3 /11 F		6			10.0	9.0	9.7	9.3		0938		1,700	
3 /12 F		5			11.4	10.8	c1.4	0.6		0834	11,449	1,650	3,099
3 /13 F		5			10.8	10.2	c0.6	9.8		0825		1,680	
3 /14 F		5			10.4	10.0	c0.8	9.8		0825		1,600	
3 /15 F		6			10.8	10.0	.0.6	0.0		0817		1,550	
3 /16 F		6			10.2	9.0	c0.0	9.2		0829		1,500	
3 /17 F		6			11.0	9.9	.0.9	9.8		0919	73	1,480	3 21
3 /18 F		7			9.6	8.6	9.5	8.6		0831		1,710	
3 /19 F		7			10.0	8.8	9.4	8.2		0851		1,720	
3 /20 F		6			9.8	8.0	9.0	8.2		0840		1,720	
3 /21 F		7			9.6	8.6	9.4	8.6		0900	,373	1,720	3,093
3 /22 F		7			9.8	9.0	0.0	9.0		0903	c,609	1,700	3,309
3 /23 F		7			9.4	8.1	9.1	8.3		0844	.,731	1,750	3,481
3 /24 F		7			9.3	8.4	9.3	8.5		0837	c,609	1,740	3,349
3 /25 F		7			9.5	8.0	9.1	8.3		0845	.09	1,730	3,339
3 /26 F		7			9.5	8.0	9.2	8.4		0945		1,700	
3 /27 F		7			9.6	8.6	9.8	9.0		0923		1,730	
3 /28 F		9			0.0	8.6	10.0	9.0		1009		1,730	
3 /29 F		7			0.2	8.8	9.8	9.0		0809		1,750	
3 /30 F		8			0.2	8.6	0.0	8.8		0819		1,750	
3 /31 F		7			9.8	9.0	cc2.0	0.2		0842	,261	1,740	,001
4 / 4 F		10			0.4	9.2				1617		1,750	
4 / 5 F		8			.0.0	8.8				0822		1,720	
4 / 6 F		8			9.6	8.8				0850	1,151	1,720	2,871
4 / 7 F		8			9.8	---				0845	3,256	1,240	4,496
4 / 8 F		6			10.4	9.8				0954		1,210	
4 / 9 F		6			10.6	9.8				0812		1,250	
4 /10 F		6			10.0	9.2				1417		1,230	
4 /11 F		7			10.4	9.8				0834		1,240	
4 /12 F		7			10.0	9.0				0843		1,210	
4 /13 F		8			9.8	9.2				0904	1,373	1,220	2,593

Appendix C, (cont.)

Date	Minthorn Intake DO 1/	Minthorn Intake Tmp 2/	Proposed Intake DO	Proposed Intake Tmp 3/	Lower Rway Head DO	Lower Rway Outlet DO 4/	Upper Rway Head DO	Upper Rway Outlet DO	Just above Intake DO	Tire	Water---(gpm)--- over weir 5/	Water---(gpm)--- through facility 6/	TOTAL
4 /14 F		8			9.8	9,2				0834		1,190	
4 /15 F		9			9.3	8.7				0855		1,210	
4 /16 F		8			9,6	9.2				0832		1,220	
4 /17 F		8			9.5	8.5				0821		1,230	
4 /18 F		8			9,6	9.2				0822		1,230	
4 /19 F		8			10,0	9,2				0821		1,220	
4 /20 F		8			9.6	9.0				0837		1,220	
4 /21 F		9			9.5	8,6				0851		1,220	
4 /22 F		8			9.9	9.1				0832	1,490	1,210	2,700
4 /23 F		8			10,0	9.1				0903		1,230	
4 /24 F		8			9,8	8,6				0900		1,230	
4 /25 F		9			9.8	9,2				0903		1,210	
4 /26 F		9			10.4	9.4				0848		1,220	
4 /27 F		9			8.4	7.0				0843		1,210	
4 /28 F		9			9.8	9.0				0917		1,250	
4 /29 F		8			9.5	8,8				0952		1,240	
4 /30 F		8			9.6	9,1				0903		1,220	
5 / 1 F		10			10,0	8.8				0817		1,240	
5 / 2 F		9			10.2	9.0				0848		1,220	
5 / 3 F		9			10,0	8.8				0834		1,220	
5 / 4 F		9			9.0	7.6				0843		1,230	
5 / 5 F		9			9,2	7.2				0825		1,220	
5 / 6 F	8.3	10	10.2	10	9.6	9.0				0846	843	1,600	2,443
5 / 7 F	7.9	10			9,4	8.6				0828		1,560	
5 / 8 F	8.8	10			10,1	8.8				0842		1,540	
5/9 F	8,6	10			9,8	8.8				0835		1,480	
5 /10 F	8,4	10			10,0	8,8				0815		1,500	
5 /11 F	8,4	9			9,8	9.0				0901		1,480	
5 /12 F	8.2	9			9.8	8.0				0846		1,560	
5 /13 F		9			10.4	9.5				0840		1,560	
5 /14 F		10			10,0	8.1				0813		1,560	
5 /15 F	8,6	10			9.8	8,8				0938		1,540	
5 /16 F	8,6	10			9.8	8.4				0845		1,560	
5 /17 F		10			9.8	8.4				0827		1,530	
5 /18 F	9.0	9			10.2	9,8				0835	656	1,560	2,216
5 /19	9,1	9	9.9	9						0948		1,580	
5 /25	8.6	10	8,8	10						0853			
6/1	9.0	10	9.8	9						0945			
6/8	9,8	10	9.2	10						0842			
6 /15	8.4	12	9.0	9						0920			
6 /22	7.4	13	a.2							0922			
6 /29	8,0	12	8,4	12						0931	486		486
7/7		13								0920			
7 /13	6.4	13	8.4	13						0930	407		407
7 /20	6.2	14	6.8	12						0939	333		333

Appendix C. (cont.,)

Date		Minthorn Intake DO 1/	Minthorn Intake Tmp 2/	Proposed Intake DO	Proposed Intake Tmp 3/	Lover Rway Head DO	Lover Rway Outlet DO 4/	Upper Rway Bead DO	Upper Rway Outlet DO	Just above Intake DO	Time	Water---(gpm) over weir 5/	Water---(gpm) through facility 6/	TOTAL
7 /27		7.6	13	6,6	13						0935	264		264
8/4		7,4	13	6,6	13						0930	264		264
8 /10		6.5	14	9.8	13						0933	407		407
8 /17		6.4	14	9,4	13						0905	486		486
8 /24		6,6	13	9.6	13						0850	407		407
8 /31		6,6	13	7.8	12						0811			
8 /31		9.6	16	6,5	16						2230			
9 / 1		8.5	15	5.9	13						0010			
9/1		7.9	14	5.9	13						0214			
9/1		1.0	14	6.0	12						0413			
9/ 1		6.5	13	6,1	12						0611			
9 / 1		6.1	13	7.0	12						0810			
9/ 7		7.0	12	8.8	11						0833	407		407
9 /14		7.8	12	8.0	12						0955	569		569
9 /21		7.0	12	7,2	10						0830			
9 /26						9.6		0,6			1100			
9 /26						9.8		lo,5			1151			
9 /26						8.6					1452			
9 /26						8,6		9,t			1546			
i /26						11,6		1088			1554			
i /27	F												1,240	
9 /28	F	7,2	12	7.4	10	7,8	7-E	7,0	6,2		0845			
9 /29	F	1.8	--	5.6	12	10,1	9.6		728		0633		1,560	
i /30	F	6.9	14	5.1	13	7.6	6.9	7.3	6.7		0621		1,640	
10/1	F	7,5	12	6.0	12	72	7.2	7.8	7.3		0609		1,690	
10/2	F	-	--	6,0	12	8.3	7.6	8.4	7.5		0607		1,600	
10 / 3	F	99	10	7.8	10	14.0	13.2	14,8	14.0	8.7	0610		1,660	
10 / 4	F	7.8	9	6,4	12	8,4	8.2	7,8	7.1	9.0	0618		1,640	
1015	F	8.6	11	6.1	12	9.3	8.4	9.2	8.4	6.2	0615		1,660	
10/6	F	8.2	11	6,8	10	9.1	8.4	9.2	8,2	7.0	0618		1,620	
10/7	F	8,2	11	6.6	10	8.8	8.0	8.8	8,0	6.8	0608		1,650	
10/8	F	8.4	11	6.0	12	8,4	8,2	7.4	7.4	5.8	0600		1,640	
10/9	F	8.2	12	5.7	12	8.1	7.9	7.2	7.1	5,6	0606		1,630	
10 /10	F	8.4	--	5.8	11	8,8	7.6	8.4	7.4	5.8	0626		1,602	
10 /11	P	7,7	12	5,8	12	8.6	7.7	8.3	7.4	5.8	0629	407	1,560	407
10 /12	F	8,4	12	6.4	12	8,2	7.2	8.4	7,2	6.0	0627	407	1,640	407
10 /13	F	7.0	11	6,0	12	8,2	6.8	8.2	7.0	5,8	0627	486	1,630	486
10 /14	F	6.8	12	6,4	12	8.4	7.0	8.4	6.0	6.0	0628	486	1,640	486
10 /15	F		9		10						0627	407	1,640	407
10 /16	F		9		8						0614		1,460	
10 /17	F	8.3	9	6.5	7	9.3	8.5	9,1	8.3	6.5	0614		1,530	
10 /18	F	6.8	9	5,0	9	7.2	6.6	7.0	6.6	5,0	0610		1,490	
10 /19		7.4	9	6.0	f					5,8	0622			
10 /26		6.8	10	6.4	i					5.8	0644		1,500	
11 / 2		7.1	7	7.8	7						0549			

Appendix C. (cont.)

Date	Minthorn Intake DO 1/	Minthorn Intake Tup 2/	Proposed Intake DO 3/	Proposed Intake Tmp 3/	Lower Rway Head Outlet DO 4/	Lower Rway Head Outlet DO 4/	Upper Rway Head Outlet DO	Upper Rway Head Outlet DO	Just above Intake! DO	Tire	Water---(gpm)---- over weir 5/	Water---(gpm)---- through facility 6/	TOTAL
11/9	?..		7.8	7					6.0	0602	56		569
11 /16	6.0	8	6.0	7					6.4	0623	1,045		1,045
11 /22	7.1	9	6.8	8						0609	569		569
11 /30	7.0	7	6.8	8					6.8	0610	486		486
12 I 7	7.4	9	6.8	8					6.0	0632	569		569
12 /14	7.0	6	6.2	8					6.0	0636	748		748
12 /21	7.0	7		7					6.2	0642	748		748

Revised 5/16/90 PTL File Nane: A: \DOMIN89A

1 /Dissolved oxygen in mg/1.
2 /All temperatures are taken in degrees Celcius at about the time that dissolved oxygen is recorded,
3 /Data taken at the proposed intake far the pipeline froa spring heads (Fish Hanagenent Consultants, Inc,),
4 /Data taken in the raceways during acclimation only,
5 /Calculated fror height of water over the weir.
6 /From flow meters at the facility,

Appendix D, Summary of descaling and ssoltification data for pre-release sampling in 1989,

Release site	SPP	Exper. group	Date released		Descaling % Hark	Total	Part.	None	Saoltification (X) Ssolt	Inter	Parr	N
Minthorn	Coh	Test	Har 31	All	0	0	100	1	79	20	437
				Hark				2	79	19	168
				Uark				1	78	21	269
Minthorn	Coh	Control	Har 31	All	0	0	100	0	10	90	213
				Hark				0	14	86	91
				mark				0	7	93	122
Bonifer	ChS	Test	Mar IO/May 23	All	1	21	78	49	51	0	313
Bonifer	ChS	Control	Har 27-28	All	0	24	76	43	57	0	551
Minthorn	StS	Test	Hay 17-18	All	0	3	97	8	70	22	469
Minthorn	StS	Control	Hay 17-18	All	0	4	96	20	69	11	204
Bonifer	StS	N/A	Apr 4/May 23	All	0	9	91	25	67	8	300
Minthorn	Chf	Test	Oct 18	All	0	5	95	13	87	0	896
Minthorn	Chf	Control	Oct 18	All	0	85	15	79	21	0	392
Bonifer	ChS	Test	Oct 13	All	0	1	ii	16	77	7	933
Bonifer	ChS	Control	Oct 13	All	0	1	99	13	82	5	902

Revised: 07/10/90 File Name: A:\DESCAL89

Note: Where fish were divided into two raceways, indices are non-weighted averages, Where indices for aarked and unsarked fish are differentiated, fish in the overall sample are used, Sampling was not designed to differentiate marked from unmarked.

Appendix E. Summary of hourly temperature data at Bonifer Acclimation Facility - 1989.

	JANUARY				FEBRUARY			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24					3.8	7.6	5.7	5.2
25					3.3	7.7	5.6	5.5
26					4.9	7.0	5.8	5.6
27					3.6	5.1	4.3	4.8
28					4.5	6.0	5.0	4.6
29								
30								
31								
Total	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Revised: 07-13-90 File Name: D:\123RZ\DATA\BNTEMP89

Note: Temperatures are in degrees Celsius.
Where temperatures are not given, the electronic thermograph temperatures taken were in error.

Appendix E (cont.)

	MARCH				APRIL			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	2.4	4.2	3.3	3.3	4.5	8.8	6.3	6.0
2	2.0	3.7	2.8	3.0	4.9	8.1	6.2	5.7
3	2.0	6.7	3.9	4.4	5.2	9.5	6.9	6.6
4	2.4	4.7	3.8	3.6	5.6	7.8	6.7	6.7
5	4.1	5.1	4.8	4.6	6.6	8.3	7.6	7.6
6	4.9	7.8	6.1	5.7	6.7	10.3	8.5	8.3
7	6.0	7.8	6.7	7.0	7.4	10.7	8.5	7.9
8	5.6	6.7	6.3	6.3	5.9	10.3	7.7	7.0
9	6.0	7.5	6.8	6.8	5.5	9.9	7.7	7.7
10	5.8	8.2	7.0	6.9	6.5	8.8	7.3	7.0
11	5.9	8.5	7.3	7.3	5.8	11.3	8.1	7.6
12	5.3	8.7	7.1	7.1	6.4	11.1	8.3	8.0
13	6.1	7.2	6.6	6.5	6.9	11.6	8.8	8.3
14	4.9	6.4	5.8	5.6	7.3	11.3	8.7	8.1
15	5.2	7.2	6.1	6.2	7.1	9.0	8.0	8.0
16	4.7	6.5	5.8	6.0	6.6	11.3	8.3	7.9
17	3.5	8.6	6.2	6.1	6.8	12.8	9.6	9.8
18	6.2	7.2	6.8	6.7	7.1	12.8	10.1	10.0
19	6.1	7.4	6.7	6.7	7.4	11.9	9.8	9.3
20	5.3	9.1	7.2	7.2	7.2	13.4	10.5	10.2
21	6.6	7.8	7.3	7.2	8.4	11.3	9.7	9.1
22	6.0	6.9	6.5	6.4	7.5	10.8	9.0	8.6
23	5.9	8.8	7.2	7.4	7.1	11.5	9.4	9.1
24	6.0	7.8	7.0	6.8	7.4	10.0	8.9	8.8
25	6.9	8.4	7.6	7.5	7.8	10.0	9.1	9.1
26	6.4	9.5	7.8	7.8	7.5	9.1	8.3	8.3
27	7.0	8.8	7.9	8.1	7.4	10.5	9.0	8.9
28	5.4	10.4	7.2	8.1	7.8	10.5	9.0	8.7
29	4.2	8.2	6.0	6.7	7.4	12.6	10.1	9.9
30	3.8	11.1	6.5	7.2	8.1	14.3	11.2	11.0
31	3.6	10.8	6.8	7.2				
Total	2.0	11.1	6.3	6.7	4.5	14.3	8.6	8.3

Appendix E (cont.)

	MAY				JUNE			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	8.9	10.7	9.7	9.6	10.2	14.2	11.2	11.1
2	8.5	12.2	10.3	10.9	10.8	12.8	11.3	11.9
3	8.6	13.6	11.1	11.6	10.6	12.7	11.5	11.5
4	9.5	14.4	11.8	11.9	10.5	13.1	11.7	12.0
5	9.5	13.4	11.6	11.8	10.8	13.1	11.9	12.4
6	10.5	14.3	12.4	12.0	10.7	14.1	12.2	12.4
7	10.2	16.2	13.1	13.2	10.3	14.1	12.1	12.7
8	10.5	15.7	12.9	12.7	10.9	14.4	12.4	13.2
9	10.6	14.2	12.0	11.7	11.1	14.4	12.4	12.8
10	9.5	11.6	10.5	10.3	11.4	14.1	12.6	13.1
11	8.6	12.1	10.2	10.7	11.6	15.0	12.9	13.8
12	8.0	12.7	10.5	10.9	11.9	15.0	13.4	14.3
13	8.7	13.5	11.4	12.1	12.3	13.9	13.1	13.5
14	10.3	14.1	12.1	12.3	11.9	16.8	14.0	15.4
15	9.5	14.8	12.1	12.4	11.8	13.1	12.4	12.6
16	9.8	12.9	11.5	11.7	11.0	16.7	13.8	16.0
17	10.5	13.7	12.0	12.5	13.1	17.1	14.9	15.8
18	10.0	11.8	10.9	11.0	13.3	18.3	15.9	17.5
19	9.0	12.8	10.8	10.9	15.0	18.1	16.4	17.3
20	9.1	14.4	11.8	12.3	14.1	16.1	15.1	15.3
21	10.1	13.9	11.9	11.9	12.5	17.7	15.1	17.1
22	10.2	14.4	12.4	12.7	13.8	16.0	15.0	15.2
23	10.3	12.5	11.2	10.8	12.6	18.2	15.6	17.4
24	9.2	13.1	10.7	10.6	14.2	19.6	17.1	18.5
25	9.4	14.8	11.6	12.0	14.7	19.3	17.3	18.8
26	9.6	13.4	11.4	11.8	15.1	19.5	17.5	18.3
27	10.0	11.2	10.6	10.7	13.6	16.6	15.2	15.4
28	8.8	13.3	10.7	10.9	13.4	16.2	14.8	15.7
29	9.6	10.9	10.2	10.4	13.3	19.3	16.3	18.2
30	9.5	15.0	11.9	12.5	15.9	19.0	17.2	17.5
31	9.8	16.2	12.8	13.3				
Total	8.0	16.2	11.4	11.8	10.2	19.6	14.1	15.3

Appendix E (cont.)

	JULY				AUGUST			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	14.4	16.2	15.2	15.1	16.2	19.2	17.5	17.5
2	13.6	19.1	16.1	16.2	15.6	18.7	17.0	16.8
3	15.2	19.7	17.4	17.5	15.7	19.1	17.1	16.9
4	15.7	19.6	17.7	17.7	15.4	20.5	18.0	17.3
5	15.8	20.0	17.8	17.9	16.5	21.6	18.8	18.4
6	15.7	20.5	18.1	18.1	17.3	22.3	19.7	19.2
7	16.2	21.3	18.4	18.2				
8	15.6	20.0	17.8	17.6				
9	15.3	19.6	17.6	17.8				
10	15.4	20.2	17.7	16.8				
11	15.6	20.1	18.0	18.1	16.2	17.2	16.7	16.9
12	17.0	18.8	17.8	17.4	16.1	17.1	16.6	16.7
13	16.7	21.7	19.0	19.3	15.9	16.5	16.3	16.5
14	17.6	20.9	18.9	19.6	15.9	16.8	16.3	16.5
15	16.5	19.7	17.8	17.1	15.8	17.1	16.4	16.7
16	15.5	17.0	16.1	15.7	15.0	16.8	15.7	16.2
17	15.1	20.2	17.5	17.6	15.7	16.4	16.1	16.2
18	17.0	21.8	18.9	18.5	15.9	16.6	16.3	16.4
19	17,7	22.2	19.8	19.8	16.0	16.7	16.3	16.3
20	18.2	22.3	19.9	20.0	16.0	16.8	16.4	16.4
21	16.5	20.5	18.5	18.0	15.7	16.8	16.3	16.2
22	15.8	20.8	18.2	18.4	15.3	15.9	15.7	15.6
23	16.5	21.4	18.9	19.1	13.5	15.4	14,6	14.5
24	17.2	21.4	19.0	18.2	13.1	13.5	13.3	13.4
25	16.7	19.7	18.4	18.7	13.4	14.3	13.8	13.9
26	16.7	19.7	18.2	17.1	14.4	14.7	14.6	14.6
27	16.2	20.8	18.4	17.9	14.8	15.6	15.4	15.2
28	16.2	21.1	18.5	18.2	15.2	15.7	15.4	15.3
29	16.6	21.2	18.5	17.5	15.0	15.8	15.4	15.2
30	16.9	21.4	18.9	18.7	14.7	15.6	15.1	14,9
31	16.8	21.1	18.8	18.4	14.1	15.0	14.6	14.5
Total	13.6	22.3	18.1	18.0	13.1	22.3	16.1	16.3

Appendix E (cont.)

	SEPTEMBER				OCTOBER			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	14.4	15.0	14.8	14.9	13.1	13.7	13.3	13.3
2	14.7	15.3	15.0	14.8	12.6	13.2	13.0	12.9
3	13.2	14.7	13.8	13.4	10.5	12.6	11.7	12.5
4	13.5	14.2	13.9	13.8	10.5	12.3	11.5	11.8
5	14.0	14.7	14.3	14.3				
6	13.3	14.6	14.1	13.5	11.6	14.0	12.8	13.7
7	13.1	14.1	1 8.	13.4	11.8	13.1	12.6	12.9
8	13.4	14.1	13.8	13.5	11.9	13.4	12.6	13.1
9	13.4	14.0	13.8	13.5	11.9	13.3	12.6	13.1
10	12.7	14.0	13.4	12.8	12.1	14.7	13.3	14.5
11	12.9	14.1	13.4	13.4	12.7	13.9	13.2	13.0
12	13.1	13.5	13.3	13.2	12.0	12.9	12.5	12.8
13	13.1	13.9	13.5	13.7	11.8	13.0	12.3	12.6
14	13.5	14.1	13.7	13.6	12.5	13.3	12.8	13.0
15	13.5	14.4	14.0	13.8	11.8	12.6	12.1	12.2
16	13.5	14.2	13.9	13.6	11.5	12.1	11.8	12.1
17	13.4	13.9	13.7	13.7	11.4	12.1	11.8	12.1
18	13.0	13.7	13.4	13.4	11.6	12.3	12.0	12.3
19	12.8	13.3	13.2	12.8	11.8	12.6	12.2	12.6
20	12.8	13.5	13.0	12.8	12.3	12.6	12.5	12.6
21	12.8	13.4	13.0	13.0	12.5	12.6	12.6	12.6
22	12.8	13.6	13.2	13.4	12.3	12.6	12.4	12.4
23	13.1	13.9	13.5	13.6	12.3	12.8	12.5	12.7
24	13.1	14.2	13.8	13.9	12.0	12.6	12.3	12.3
25	13.5	14.4	14.0	13.9	10.0	12.5	11.0	10.8
26	13.6	14.2	13.9	13.9	9.1	10.8	10.2	10.8
27	13.3	13.8	13.6	13.4	10.2	10.9	10.4	10.3
28	13.1	13.8	13.5	13.5	9.7	11.3	10.3	10.5
29	13.3	14.0	13.6	13.7	7.4	9.6	8.8	9.6
30	13.5	13.9	13.7	13.7	7.9	10.3	9.2	10.1
31					9.1	11.3	10.1	10.5
Total	12.7	15.3	13.7	13.6	7.4	14.7	11.9	12.6

Appendix E (cont.)

	NOVEMBER				DECEMBER			
DAY	MIN.	MAX.	AVE.	MED.	MIN.	MAX.	AVE.	MED.
1	7.7	10.0	9.0	9.2	6.7	7.4	7.0	7.0
2	7.8	9.5	8.7	9.2	6.7	7.4	7.0	7.3
3	9.2	11.0	10.1	10.2	6.5	9.2	7.6	6.9
4	10.9	12.4	11.6	11.4	8.6	10.2	9.5	9.1
5	10.4	11.3	10.8	11.0	9.6	11.1	10.2	9.8
6	9.9	10.7	10.2	10.3	9.2	10.0	9.6	9.5
7	9.2	10.5	9.8	9.7	8.1	9.8	9.0	8.8
8	8.6	10.0	9.3	9.8	8.8	10.4	9.5	8.9
9	10.1	11.9	11.1	11.0	8.1	10.0	8.9	9.1
10	11.6	13.1	12.2	12.1	7.8	9.0	8.2	8.1
11	10.5	12.4	11.4	11.9	6.4	7.8	7.1	7.2
12	10.5	11.6	10.9	11.2	5.3	6.6	5.9	5.8
13	9.9	11.4	10.6	10.5	5.5	6.6	6.1	6.2
14	8.9	10.2	9.5	9.5	6.2	6.9	6.5	6.3
15	7.2	8.8	8.1	8.7	6.4	7.5	6.8	6.7
16	8.0	9.0	8.5	8.9	6.0	7.0	6.4	6.6
17	9.1	10.2	9.8	9.7	5.9	6.6	6.2	6.3
18	8.6	10.7	9.7	10.1	5.6	6.6	6.1	5.8
19	9.0	11.0	9.9	10.1	6.3	7.8	6.9	6.5
20	9.5	10.6	10.2	10.5	6.0	6.8	6.3	6.4
21	10.2	10.8	10.4	10.4	6.4	7.8	7.1	6.9
22	7.8	10.3	8.8	9.4	6.2	7.4	6.7	6.8
23	8.5	9.6	9.0	8.9	6.1	7.5	6.7	6.5
24	8.6	9.5	8.9	8.7	6.5	7.6	6.9	7.0
25	8.0	9.5	8.8	8.7	6.5	7.2	6.8	6.7
26	8.3	9.1	8.8	8.7	5.9	6.9	6.3	6.3
27	7.5	9.1	8.2	8.4	5.6	6.6	6.1	6.1
28	6.9	8.8	7.8	7.7	5.4	6.1	5.8	5.5
29	5.9	7.5	6.9	7.1	5.3	6.1	5.8	5.9
30	6.7	7.4	7.1	7.3	5.7	6.6	6.0	5.8
31					5.3	6.7	5.9	6.0
Total	5.9	13.1	9.5	9.7	5.3	11.1	7.1	6.7

Appendix F, Dissolved oxygen and tenperture at Bonifer Acclimation Facility in 1989,

Date		Dissolved oxygen (mg/l) Outlet	Springs #I	#2	#3	Proposed P#1	P#2	Tenperature (degrees C) 6/ Outlet TpM	aeter	Springs #1	#2	13	Proposed P#1	P#2	Water ovr weir (gpm)	Tine
1 / 5		8.2	7.8	1.2	8,6				13	12	13	12			407	1101
1 /12		9.6	9.2	1.7	a.4			6.5	a	a	7	9			1856	1018
1 /19		9.4	8.8	7.6	8.6			5.3	8	8	7	9			1856	1015
I /26		8.4	8.8	7.8	a.4			3.6	4	5	6	5			1856	1005
2 / 2								3.0	1	2	2	2			1856	1055
2 / 9		9.0	10,0	9.0	10.1											
2 /I6		10.0	9.0	9.0	10.0			3.8	2	2	2	3			1731	1045
2 /23			9.0	9.2	9.6					3	3	4				0945
2 /23		8.0							3						1856	1130
3 / 3		11.0	11,3	10.6	10.4			4.2	5	5	6	5				1045
3 / a	F	11.0	11.0	10.0	10.2			5.2	6	5	6	6				1128
3 / 9	F	9.8	10.4	10.2	10.0				7	6	7	6				1043
3 /lO	F	10.4	10.6	10.6	11.2			6.8	7	9	5	7			8180	1213
3 /11	F	10.4	11.0	11.2	11.2			6.4		7	6	6				1049
3 /I2	F	10.6	10.8	10.4	10.4			5.1	7	8	6	6				1107
3 /13	F	8.6	10.6	10.4	10.6			6.2	6	7	6	6				1140
3 /14	F	10.4	10.6	10.4	10.8				6	6	7	6				1045
3 /15	F	10.2	10.6	10.6	10.8			5.6	6	9	6	6				1139
3 /16	F	10.6	10.4	10.6	10.6				6	8	6	6				1314
3 /11	F	10.2	11.3	10.2	11.1			5.3	7	10	6	7				1200
3 /18	F	9.6	11.2	10.2	9.8			6.4		8	6	7				1014
3 /19	F	9.7	10/9	10.0	9.9			6.1	6	7	6	6				1042
3 /20	F															
3 /21	F	10.4	11.6	10.8	10.9			7.2	a	10	6	7			1238	1149
3 /22	F	9.4	11.4	10.4	10.4			6.4	7	8	6	7			1731	1030
3 /23	F	10.0	12.2	11.1	11.2			6.6	7	9	6	7			740	1055
3 /24	F	10.0	11.6	11.3	10.4			6.4	6	9	6	7				1101
3 /25	F	9.6	11,6	10.5	10.6			7.5	7	9	6	7				1047
3 /26	F	11.2	10.8	11,O	10.4											1105
3 /27	F	9.8	10.4	10.0	10.2			7,7	77	11	66	7				1125
3 /28	F	10.6	10.4	10.6	10.4			8.0	6	9	6	7				1205
3 /29	F	10.0	10.2	10.6	10.4			7,8	7	10	7	6				1200
3 /30	F															
3 /31	F	10.6	11.0	10.0	10.2			9,2	7	8	6	6				1002
4 / 4	F								8							
4 / 5	F	10.4	10.8	10.0	10.4				7	8	7	6				1032
4 / 6	F	9.8	11.0	9.8	10.5			8,O	10	14	7	9			942	1259
4 / 7	F	9.2	10.0	8.6	9.2			8.0	8	11	7	7				1013
4 / 8	F	9.8	10.4	9.2	9.6				7	10	7	7				1049
4 / 9	F	10.0	10,O	9.4	9.8				8	9	7	7				1017
4 /10	F	10.2	10.2	9.8	10.2			6.9	7	10	7	7				1125
4 /11	F	10.6	10.4	10.4	10.2											1113
4 /12	F		10.6	9.8	9.8			7.3	8	10	10	aa				1109
4 /13	F	9.6	10.1	9.1	9.7			1.8	7	12	8	8				1133
4 /14	F	9.9	10.3	9.3	9.7			7.4	8	11	7	8				1040
4 /15	F	9.4	10.0	IO.2	10.3			7.4	8	11	7	7				1002

Appendix F.(cont.)

Date 2/		Dissolved oxygen (mg/l) Outlet	Springs #1	Springs #2	Springs #3	Proposed P#1	Proposed P#2	Tesperature (degrees C) 6/ Outlet TpM	Outlet meter	Springs #1	Springs #2	Springs #3	Proposed P#1	Proposed P#2	Water ovr weir (gpm)	Tire
4/16	F	10.1	10.0	8.7	9.1				8	10	7	7				0937
4/17	F	9.9	10.1	9.2	9.2				8	10	7	8				1010
4/18	F	8.0	10.8	9.2	9.2			8.1	10	10	7	8				1038
4/19	F	10.4	10.0	10.0	10.2			8.8	8	12	8	7				1040
4/20	F	10.2	9.2	10.6	9.0			8.2	8	11	8	7				1040
4/21	F	9.2	9.8	7.9	9.3			8.4	9	11	8	8				1111
4/22	F	9.3	10.0	8.8	9.2				8	10	8	10				1015
4/23	F	9.9	9.2	8.8				7.8	8	10	7					1104
4/24	F	9.8						8.3								
4/25	F	11.2	11.2	10.8	10.4			9.5	8	IO	8	9				1012
4/26	F	10.0	10.0	9.0	9.4			8.8	8	10	8	8				1212
4/27	F	9.4	10.2	8.8	9.4			8.1	8	10	8	7				1113
4/28	F	10.0	10.0	8.3	9.4				10	9	8	8			1373	1051
4/29	F	9.2	9.8	8.6	10.1				9	9	8	7				1008
4/30	F	10.4	10.0	9.8	10.1				10	13	11	10				1118
5/1	F	9.0	10.3	8.0	8.4			9.1	9	8	8	8				1025
5/2	F	10.0	10.0	8.2	9.0			9.6	9	10	9	8				1050
5/3	F	10.4	9.8	9.8	10.0			9.8	9	11	10	9				1113
5/4	F	10.4	9.4	8.0	8.4				10	11	8	8				1140
5/5	F	10.8	9.0	9.6	10.4			9.8	9	12	10	10				0958
5/6	F	10.1	9.8	7.8	9.2	9.0	9.9	10.8	12	13	11	9	9	9		1121
5/7	F	11.1	10.1	9.0	9.7			10.5	11	13	9	11			748	1055
5/8	F	9.6	9.5	7.8	8.6			10.6	11	11	9	8				0945
5/9	F	10.8	10.2	8.8	9.8			10.6	11	12	9	10				0943
5/10	F	9.2	9.3	7.0	8.6	8.7	8.0	10.0	10	10	9	8	8	8		1054
5/11	F	9.6	[illegible]		9.8			10.4	10	10	8	8				
5/12	F	10.6	9.0	8.2	9.0			9.8	10	10	8	8				1103
5/13	F	10.4	9.8	8.4	10.2			10.3	10	13	10	10				1143
5/14	F	10.4	10.2	7.4				10.5	11	11	9					1009
5/15	F	10.2	10.0	7.2	9.8			10.3	10	12	11	10				1145
5/16	F	10.4	9.8	7.4	10.0			11.4	11	12	10	10				1155
5/17	F	10.4	9.8	7.4	10.2			10.9	11	14	11	10				1051
5/18	F	9.6	9.9	7.3	8.4	8.6	7.8	10.2	10	10	10	9	9	8	1151	1004
5/19	F															
5/23	F															
5/25		10.0	9.8	8.0	8.4	8.6	7.9	9.5	9	10	10	9	9	8		1015
6/1		10.0	10.0	8.4	8.4	8.2	8.0	12.6	9	12	11	9	9	8		1107
6/8		10.0	10.0	8.8	8.6	8.0	8.4	11.1	10	11	10	9	10	9		1022
6/15		9.2	10.0	8.8	8.4	9.0	8.8	12.2	13	10	10	9	10	10		1322
6/22		9.0	9.8	9.2	9.4	8.6	9.0		12	12	11	11	10	10		1034
6/29		10.2	8.8	9.4	9.0	8.4	9.0		13	14	12	11	10	10		1118
7/7		9.1	9.1	8.7	10.4				18	17	13	14		10	264	1445
7/13		8.2	7.8	7.4	7.8	6.4	5.8		15	15	14	13	12	14		1114
7/20		7.6	1.2	6.4	9.0	8.2	8.6		13	15	14	12	13	13		1100
7/27		7.8	1.0	6.0	8.8	8.4	8.6		13	15	13	12	13	13		1201
8/4		7.6	6.8	6.0	8.6	8.6	8.4		13	15	13	12	13	13		1128

Appendix F, (cont,)

Date	Dissolved oxygen (mg/l) Outlet	Springs. #1	#2	#3	Proposed P#1	P#2	Temperature (degrees C) 6/ Outlet TpM	meter	Springs #1	#2	#3	Proposed P#1	P#2	Water ovr weir (gpm)	Tile
2/															
8 /10	10.6	9.2	5.8	9.0	7.4	1.1		18	14	16	15	13	13	144	1053
8 /17	10,2	9.0	6.0	8.0	1.8	7.4	16.0	16	13	15	15	13	13	93	1051
8 124	10.6	8.8	6.4	9.2	6.8	6.4	13.1	13	14	15	14	13	14		1035
8 /31	8.6	9.0	5.6	10.2	6.8	6.6	15.0	13	13	15	13	12	13		1050
9/ 7	8.8	9.0	6.0	10.2	6.6	7.0	14.2	13	14	15	13	12	12		1018
9 /14	11.0	10.0	4.6	8.8	7.3	7.5	13.8	15	12	15	12	14	13	51	1102
9 /21	11.0	10.2	5.0	8.6	7,2	7.4	13.2	14	12	14	12	14	13	51	1008
9 /28	7.0	10.2	5.4	8.4	7.2	7.2	13.5	13	12	12	11	13	13		1048
10 / 4	7.2	9.0	5.8	9.8	6.8	6.4	13.4	12	11	15	13	13	14	486	1150
10 /IO F	8.8							13							0714
10 /Il F	4.6	8.0	5.2	6.0	6.5	6.5	13.0		10	14	13	13	14	144	0823
10 /I2 F	6,O	8.2	5.0	6.0	6.8	6.6	12.1	12	11	14	12	13	13	201	0911
10 /13 F	5.8	8.0	5.2	6.2	6.4	6.6		12	11	14	13	13	13	201	0906
10 /19	6 . 4	8.4	6.2	7.0	6.6	6.4		12	1 0	13	13	12	12		0818
10 /26	8.1	9.4	6,6	6.6	7.0	7.4	9.1	9	7	13	11	12	12	569	0751
11 I 2	6.2	8.8	6.0	6.0	6.4	6.6	8.0	8	5	12	10	12	11	333	0654
11 I 9	7.0	6.6	6.6	6.4	7.0	7.4		12	11					407	0718
11 /16	8.0	9.0	6.0	5.6	6.4	6.0		5	5	7	8	7	7	333	0750
11 122	8.1	8.9	6.9	1.5	7.1	7.3	8.8		6	11	10	12	12	333	0106
11 /30	8,O	8.2	6.2	6.2	6.4	6.6	7.1							333	0725
12 I7	7.0	8,8	6.0	6.8	7.4	7.2	8.6							333	0713
12 /14	8.8	8.6	6.4	7.0	7.0	6.8	6.4							407	0730
12 /21	8.2	8.8	6.2	6.8	7.0	6.8	6.7							333	0732

Revised 06/06/90 File Name A:\DOBON89A

2/ An F indicates that fish were in the facility,

Appendix G, Summary of descaling data for salmonids captured at Westland Diversion in 1989. /1

Date	Coho Salmon N	Total	Partial	None	Chinook Salmon N	Total	Partial	None	Hatchery Steelhead N	Total	Partial	None
4/4	78	7	33	60	7	0	14	86	--	--	--	--
4/12	195	2	31	67	9	0	22	78	--	--	--	--
4/16	47	0	55	45	13	a	0	92	—	--	--	--
4/20	50	4	36	60	21	5	24	71	--	--	--	--
4/23	24	0	29	71	5	0	40	60	5	0	20	80
4/24	27	4	26	TO	15	13	7	80	--	--	--	--
4/30	18	0	39	61	4	0	25	75	1	0	100	0
5/4	40	4	48	48	4	0	25	75	2	0	50	50
5/15	122	2	45	53	5	0	20	80	22	0	50	50
5/25	4	0	50	50	2	0	50	50	10	0	70	30
6/2	29	7	28	65	11	0	64	36	41	2	71	27
6/6	10	0	20	80	--	--	--	--	79	9	62	29
6/8	16	0	31	69	--	—	—	--	98	5	59	36
6/15	2	50	0	50	1	0	0	100	9	22	67	11
6/28	3	0	33	67	6	0	0	100	5	0	40	60
Totals	665	3	37	60	106	4	21	75	272	6	61	34

Revised: 7/24/90 File Name: D:\l23R2\DATA\WLDESM89

/I Numbers reported are in percent except N eguals number of fish sampled,

Appendix H. Summary of snoltification data for salmonids captured at Westland Diversion in 1989, /1

Date	Coho Salmon N	Smolt	Inter,/2	Parr	Chinook Salmon N	Smolt	Inter,	Parr	Hatchery Steelhead N	Smolt	Inter,	Parr
4/4	78	4	96	0	7	0	100	0	--	--	--	--
4/12	193	5	94	1	9	78	22	0	--	--	--	--
4/16	47	11	87	2	13	100	0	0	--	--	--	--
4/20	50	14	86	0	21	90	10	0	--	--	--	--
4/23	24	17	83	0	5	100	0	0	5	100	0	0
4/24	27	15	85	0	15	93	7	0	--	--	--	--
4/30	18	39	61	0	4	100	0	0	1	100	0	0
5/4	39	10	90	0	4	50	50	0	2	0	100	0
5/15	122	53	41	0	5	100	0	0	22	55	45	0
5/25	4	50	50	0	2	100	0	0	10	70	30	0
6/2	27	93	7	0	11	100	0	0	40	88	12	0
6/6	10	100	0	0	--	--	--	--	80	99	1	0
6/8	16	75	25	0	--	--	--	--	98	95	5	0
6/15	2	50	50	0	1	100	0	0	9	100	0	0
6/28	3	67	33	0	6	100	0	0	5	80	20	0
Totals	660	25	75	0	106	86	14	0	272	90	10	0

Revised: 7/24/90 File Name: D:\l23R2\DATA\WLDESM89

/1 Numbers reported are in percent except N equals number of fish sampled.
/2 Intermediate

Appendix I. Liberation and survival information for summer steelbead released in the Umatilla River, /1

Brood	CWT Code	CWT Released	Total Released	Estimated Recoveries Number	%	Year Recovered	Age at Recovery	Oregon Col. R. Gillnet	Oregon Sport	Fish Trap
87	*073859*	9829	10187	la	0.18	a9	2	6	0	12
87	*073860*	9721	10015	30	0,31	a9	2	15	0	15
87	013861	9925	10281	31	0,31	89	2	10	0	21
87	013856	9689	10423	21	0,22	89	2	0	1 I2	20
87	073857	9435	10171	27	0.29	89	2	8	0	19
87	*073858*	9448	10163	7	0.01	a9	2	0	0	7

Revised: f-12-90 File Name: D:\l23R2\DATA\STSSURV2

/1 The survival data includes l-salt fish only (1929-90 returns),
/2 Caught at mouth of Deschutes River,

Appendix J. Liberation and survival information for fall chinook salmon released in the Umatilla River, /1

Br, Yr.	CWT Code	CWT Rel,	Total Rel,	Estimated Recoveries No,	%	Tear Rec.	Age	Oregon Ocean Con	Trawl	Spt	Cl, R Gillnet	Test Fishery	Freshwater Net Spt	Hatch	Trap	Treaty Subsis	Spawn Ground
81	050851	46707	306219	12	0.03	83	2			2	10						
				178	0,38	84	3	10			69						2
				20	0.04	85	4				16						
			Totals	210	0.45												
81	051057	102331	672057	20	0.02	83	2				a						
				454	0.44	a4	3	28	1		161		3				9
				50	0.05	85	4				39		I				
				6	0.01	86	5				5						
			Totals	530	0,52												
81	072663	102386	2828835	19	0.02	83	2				2						
				356	0.35	64	3	15			120		3				7
				63	0,06	85	4			2	52				1		
				5	0.00	86	5										
			Totals	443	0.43												
81	012141	99570	100564	7	0.01	83	2				4				3		
				15	0.02	a4	3			1	11						1
				102	0.10	85	4	2		2	27	1		1	1		
				40	0.04	86	5				27				1		
			Totals	164	0.16												
82	012829	96448	228412	13	0.01	85	3	3									
				54	0.06	86	4	3			15						
				5	0.01	87	5										
				4	0,00	88	6				4						
			Totals	76	0.08												
63	013124	210441	996250	2	0.00	84	1										2
				79	0.04	85	2				16						
				487	0.23	86	3	15			203						
				859	0.41	87	4	2			418		1 3		1		
				186	0.09	88	5				118		4				
			Totals	1613	0.77												

Revised: j-12-90 File Ware: D:\123R2\DATA\CHFSURV4

/1 The adult returns from the 1984-87 brood are incomplete.

Appendix J. (cont.)

CVT Code	Year Rec.	Washington Ocean Net & Troll Com.	Spt.	Seine	Freshwater Spt.	Batch, Trap	Spawn Ground	Calif. Ocean Com.	Spt.	Canada Ocean Net & Seine Com.	Spt.	Alaska Ocean Com.	Spt.	PWS Freshwater Hatch.	Trap
050851	83														
	84	6	3	4						77	3 4				
	85									4					
051057	83									6	6				
	84	24	30	2						192	3			1	
	85		6							4					
	86														1
012663	83									7	10				
	84	14	17							168	4			1	
	85	2								4					
	86				5										
072741	83														
	84											2			
	85			20						31	3	12			
	86									11		1			
012829	85		2		6						2				
	86	4	2							19	4	6			
	87									3					
	88														
073124	84														
	85				5	8	44				2	4			
	86	5	6			8	86			149	5 4	5	1		
	87		2	2		18	187			133	6	85			
	88	2								28	2	31	1		

Revised: g-12-90

File Name: D:\123R2\DATA\CHFSURV3

Appendix J, (coat,]

Br. Yr,	CWT Code	CWT Rel,	Total Rel,	Kstiaated Recoveries No.	% Rec.	Year Age	Oregon Ocean Con,Trawl	Spt	Col, R. Test Net Gillaet	Fishery	Freshwater Spt,Hatch.	Trap	Treaty Spawn Subsis,Ground	
83	073127	88306	198162	28	0.03	85 2			13					
				113	0.13	86 3	4		27				1	
				495	0.56	87 4	47	6	185		6		1	
				75	0.08	88 5	4		32					
				Totals 711	0.81									
84	073326	206'156	3223172	28	0.01	86 2			13				2	
				340	0.16	87 3	12		130					
				794	0.38	88 4	8		511		7			
				457	0.22	89 5	6		238		1		1	
				Totals 1619	0.78									
84	073162	30838	51000	18	0.06	87 3			4					
				78	0.25	88 4			39					
				95	0.31	89 5	6		56				2	
				Totals 191	0.62									
84	073327	88396	206815	129	0.15	86 2			29				70	
				311	0.35	87 3	5	13	92		5			
				1529	1.73	88 4	38	4	478		1	20	41	
				656	0.74	89 5	5	3	335				12	5
				Totals 2625	2.91									
85	073833	20636	197432	2	0.01	87 2								
				28	0.11	88 3			17					
				59	0.29	89 4			34					
				Totals 89	0.43									
85	073834	21335	198153	8	0.04	88 3			8					
				20	0.09	89 4			20					
				28										
85	073835	20690	197488	3	0.01	89 2		3						
				4	0.02	88 3	4							
				24	0.12	89 4			15					
				Totals 31	0,15									

Revised: 9-12-90

Pile Name D:\123R2\DATA\CHFSURV4

Appendix J. (cont.)

CWT Code	Year, Rec.	Washington Ocean Net & Treaty Troll Con,	Ocean Net & Treaty Troll Spt.	Ocean Net & Treaty Troll Seine	Freshwater Spt.	Freshwater Hatch.	Freshwater Trap	Spawn Ground	Calif. Ocean Com.	Calif. Ocean Spt.	Canada Ocean Net & Seine Com.	Canada Ocean Net & Seine Spt.	Alaska Ocean Com.	Alaska Ocean Spt,	FWS Freshwater Hatch,	FWS Freshwater Trap
073127	85					15										
	86	6	12								37	20	4	2		
	87	4	30		2	17					182			15		
	88				6				9		22	2				
073326	86											13				
		3	13			2		21			122	3		16	1	
	88	22	7		2						158	5	5	67	2	
	89	7	4			5		4			67	5		119		
073162	87										9	4			1	
	88				2						30		4	3		
	89										20	2		2		
073327	86					3	12				5	9		1		
	87		36	2	10	8					20	68	35	10	2	
	88	92	48	1	71						679	1	8	42	1	
	89	12	17			20		2			189	k	8	44		
073833	87													2		
	88				2						k	5				
	89					4					16			5		
073834	88															
	89															
073835	87															
	88															
	89					3					4			2		

Appendix J. (cont.)

Br, Yr.	Code	CVT Rel.	Total Rel.	Estimated Recoveries No,	% Rec.	Year	Age:	Ocean Cos.	Trawl	Oregon Cal, Spt	IL Test Net Gillnet	Freshwater Fishery	Treaty Spawn Spt.	Hatch.	Trap	Subsis.	Ground
85	073836	20170	196952	26	0.13	88	3	2			7	3					
				45	0022	89	4				29						
			Totals	71	0.35												
85	073837	20982	197788	5	0.02	87	2										
				12	0.06	88	3				7						
				18	0.09	89	4				6						
			Totals	35	0.17												
85	073838	20815	208103	2	0.01	87	2										
				6	0.03	88	3				6						
				38	0.18	89	4				17						
			Totals	46	0,22												
85	073839	21659	208958	5	0.02	87	2				4						
				22	0.10	88	3	4			15						
				54	0.25	89	4				40						
			Totals	81	0.37												
85	073840	20269	207550	5	0.02	87	2										
				14	0.07	88	3	2			4						
				69	0.34	89	4				25						
			Totals	88	0.43												
85	073841	20895	208184	14	0.07	88	3				12						
				28	0.13	89	4				19						
			Totals	42	0.20												
85	073842	2169k	208994	18	0.08	88	3	4			14						
				35	0.16	89	4				30						
			Total6	53	0.24												
85	073823	10103	22216	4	0.01	87	2				4						
				24	0.24	88	3			4							
				112	1.11	89	4	2			44						1
			Totals	140	1.39												

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Appendix J. (cant,]

CWT Code	Year Rec.	Washington Ocean Net & Treaty Con.	Spt.	Seine	Troll	Freshwater Spt.	Hatch.	Trap	Spawn Ground	Calif. Ocean Com.	Spt.	Canada Ocean Net & Con.	Seine	Spt.	Alaska Ocean Com.	Spt.	PWS Freshwater Batch.	Trap
073836	88											12			2			
	89						4		1			3		2	6			
073837	87													5				
	88											5						
	89						4		1			7						
013838	87													2				
	88																	
	89						2					4			15			
013839	87						1											
	88											3						
	89						1					9			4			
073840	87						1									4		
	88											a						
	89						5					36			3			
073841	88		1									1						
	89								1			3			2			
073842	88																	
	89						5											
013823	87																	
	88					4								5	4	1	2	
	89	2	2		3		1					38		4	1	6	1	

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Appendix J, (cont.)

Br, Yr.	CYT Code	CWT Rel,	Total Rel,	Estimated Recoveries No,	%	Year Rec.	Age;	Oregon Ocean Com.Trawl	Ocean Spt	Ocean Cal, Gillnet	Freshwater R, Test Fishery	Freshwater Net Spt,	Freshwater Hatch.	Freshwater Trap	Treaty Subsis.	Spawn Ground
85	073824	10243	22523	4	0,04	87	2			3			1			
				33	0.32	88	3					4		4		
				131	1.28	89	4	6	2	54				3		1
			Totals	168	1.64											
85	073825	9917	21807	5	0.05	87	2			3			1			
				24	0.24	88	3			7				9		
				97	0.98	89	4	8		31				7		
			Totals	126	1.27											
85	013826	9496	20881	4	0,04	87	2			3			1			
				26	0.27	88	3			9				6		
				90	0.95	89	4	1		31		3		6		
			Totals	120	1.26											
85	073827	9876	21716	8	0.08	87	2			8						
				12	0.12	88	3		2							
				106	1.07	89	4		3	36						
			Totals	126	1.28											
83	073828	10253	20786	17	0.17	88	3			4				1		
				109	1.06	89	4	12	1	33		3		2		
			Totals	126	1.23											
85	073829	9970	20212	27	0.27	88	3			7		4		1		
				106	1.06	89	4	6		27				1		
			Totals	133	1.33											
85	073830	10135	20546	10	0.10	87	2									
				28	0.28	88	3			4				3		
				127	1.25	89	4			62			1	3		
			Totals	165	1.63											

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Appendix J, (cont,)

CWT Cod	Year Rec	Washington Ocean Net & Troll Con,	Spt,	Treaty Seine	Spt,	Freshwater Batch.	Trap	Spawn Ground	Calif, Ocean Com,	Spt.	Canada Ocean Net & Seine	Spt.	Alaska Ocean Com.	Spt.,	FWS Freshwater Batch,	Trap
073824	87	7														
	88		10						5		7	2		1		
	89	5	9		3		1				23			24		
073825	87														1	
	88		2									2	4			
	89	2	3		1	5	1				30			7	1	
073826	87															
	88		7									3		1		
	89	5	5				1				30	3	4	1		
013821	87															
	88											2			1	
	89	2	9		7						30			11		
073828	88					4					2	5			1	I
	89	2	9		1						38	5		2	1	
073829	88		2									3	9			1
	89	7	4				2				47			12		
073830	87		3									7				
	88										6	7	4	4		
	89	5	17				4				26		4	5		

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Appendix J. (coat.)

Br,CWT Yr, Code	CUT Rel,	Total Rel.	Estimated Recoveries No.	% Rec.	Yea Age	Oregon Ocean Com.Trawl	Ocean Spt	Col. R, Gillnet	Test Fishery	Net Fresbuater Spt.	Net Fresbuater Hatch.	Net Fresbuater Trap	Treat Subsis.	Spawn Ground
85 073831	1005	20381	28	0.28	88 3			7				7		
			106	1.05	89 4	2		32				7		1
		Totals	134	1.33										
85 073832	1008	12043	8 4	0.04	87 2			4						
			16	0.16	88 3					3		1		
			103	1.02	89 4	3		53				6		1
		Totals	123	1.22										
86 07391	42793	49752	9	0.0 2	88 2			3				3		
			87	0.21	89 3			40						1
		Totals	96	0.24										
86 073 913	41096	501266	15	0.04	88 2			4						
			104	0.25	89 3		2	41				1		
		totals	119	0.29										
86 073914	3918 7	47799	214	0.04	88 2			4				7		
			98	0.25	89 3	6	2	25		6		3		
		Totals	112	0.29										
86 073915		670	0	0.00										
86 073916	645	672	0	0.00										
86 074035	632	65 8	4	0,6 3	89 3			3						
86 014038	42068	52317	262	0.62	88 2			3		17		242		
			138	0.33	89 3	5	4	39				37		
		Totals	400	0.95										
86 074039	38918	48474	221	0.57	88 2					2		219		
			100	0.26	89 3			7				52		
		Totals	321	0.82										

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Appendix J ,(cont,)

CWT Code	Year Rec.	Washington Ocean Com,	Spt.	Wet & Seine	Treaty Troll	Freshwater Spt	Hatch,	Trap	Spawn Ground	Calif. Ocean Con,	Spt.	Caasda Ocean Net Con.	Seine	& Spt,	Alaska Ocean Con	Spt.	FWS Freshwater Batch,	Trap
0138	88		5										9					
	89	7	2				3	5				30		8	8	1		
07383	87																	
	88		5		7													
	89		4					1				18	2	12	3			
07391	88												3					
	89		2					17	1			24			2			
073913	88												3	4	4			
	a9		6		1			9				29	5		9	1		
073914	a8												3					
	89				4			13			5	33			1			
073915																		
073916																		
074035	89							1										
074038	88																	
	89		11	6								3	22	8	3			
074039	88																	
	89		2	2								6	25		5			

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Appendix J, (cont,)

Br. Yr,	CWT Code	CWT Rel,	Total Rel.	Estimated Recoveries No,	%	Year Rec.	Age	Oregon Ocean Con.	Trawl	Spt	Freshwater Cal, R, Gillnet	Test Fiaherg	Net	Spt.	Hatch.	Trap	Treaty Subsis,	Spawn Ground
86	074036	39509	50480	164	0.42	88	2									164		
				139	0.35	89	3			8	28					43		
			Totals	303	0.77													
a6	074037	38405	49070	158	0.41	88	2				3					155		
				105	0.27	89	3			9	25					34		
			Totals	263	0.68													
87	075007	198285	1886757	20	0.01	89	2									10		
87	074539	4438	4823	0	0.00													
87	074540	4289	4660	0	0.00													
87	074541	4533	4925	0	0.00													
87	074536	24656	26858	2	0.01	a9	2									2		
87	074537	23403	25493	3	0.01	89	2									1		
87	074538	25089	27330	2	0.01	89	2									2		

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Appendix J, (cont.)

CUT Code	Year:	Rec.	Washington Ocean Net & Treaty Coo, Spt, Seine	Troll	Freshwater Spt. Hatch, Trap	Spawn Ground	Calif. Ocean Con, Spt.	Canada Ocean Con, Net & Seine	Spt,	Alaska Ocean Com.	Spt.	FWS Freshwater Hatch, Trap
074036	88											
	89		19		6			21	11	2	1	
074037	88											
	89		16		1		4	15		1		
075007	89				1			6				
074539												
074540												
074541												
074536												
074537	89							2				
074538												

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Appendix K. Liberation and survival infornation for spring chinook salmon released in the Umatilla River, /1

Brood	CWT Code	CWT Released	Tota1 Released	Estimated Recoveries Number	&	Year Recovered	Age at Recovery	Oregon Hatchery	Oregon Fish	Oregon Trap
86	074325	26640	35946	2	0.008	88	2	2		0
				4	0.015	89	3	0		4
				6	0.023					
			Totals							
86	074326	25863	35148	0	0.000	88	2	0		0
				3	0.012	89	3	0		3
			Totals	3	0.012					
86	074327	25853	35137	0	0.000	88	2	0		0
				2	0.008	89	3	0		2
			Totals	2	0.008					
86	074328	26319	34187	1	0.004	88	2	1		0
				3	0,011	a9	3	0		3
			Totals	4	0.015					
86	074329	25722	33573	2	0.008	88	2	2		0
				4	0,016	89	3	0		4
			Totals	6	0.023					
86	074330	26252	34118	0	0.000	88	2	0		0
				2	0,008	89	3	0		2
			Totals	2	0,008					
87	074420	416	410	0	0.000	89	2			
87	074423	399	393	0	0.000	89	2			
87	074424	381	376	0	0,000	89	2			
87	074427	26109	25987	0	0,000	89	2			
87	074429	24183	24070	2	0,008	89	2			2
87	074430	25475	25356	0	0.000	89	2			

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/l The survival data includes age-2 and age-3 fish only (1988 and 1989 returns),

Appendix L. Liberation and survival information for coho salmon released in the Umatilla River, /1

Brood	CUT Code	CUT Released	Total Released	Estimated Recoveries No,	%	Year Recov,	Age	Oregon Ocean Comm.	Sport	Freshwater Col, R. Gillnet	Test Fishery	Net /2 Sport	Hatch,	Trap
85	073617	13440	37245	1	0.01	87	2						1	
				260	1.93	88	3	84	20	77	1	14	2	13
			Total	261	1.94									
85	073624	19819	53754	0	0.00	87	2							
				329	1.66	88	3	94	52	84		26	6	9
			Total	329	1.66									
85	073625	26740	70890	0	0.00	87	2							
				405	1.51	88	3	155	47	100		17	5	10
			Total	405	1.51									
86	074356	20592	68208	39	0.19	88	2			11			I4	22
				818	3.97	89	3	185	127	172			7	93
			Total	857	4.16									
86	074357	19038	73650	25	0.13	88	2						I4	25
				734	3.86	89	3	200	112	127		3	2	104
			Total	759	3.99									
86	074358	18588	61606	22	0.12	88	2						/5	22
				727	3.91	89	3	187	132	117		6	8	104
			Total	149	4.03									
87	074609	27062	15910	7	0.03	89	2							7
87	014610	26416	72627	13	0.05	89	2							13
87	074611	26739	84672	16	0.06	89	2		2					14

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/1 Survival data for the 1981 brood includes age-2 fish only (1989 returns).
/2 Estuary Recoveries
/3 Jetty Recoveries
/4 Cascade Hatchery
/5 ?-Cascade Hatchery; l-Bonneville Hatchery

Appendix I, (cont,)

CYT Code	Year Recov,	Washington Ocean Comn.	Sport	Net & Seine	Treaty Troll	FW /3 Sport	California Ocean Comn.	Sport	Canada Ocean Comn.	Sport	Net & Seine	PWS Hatch,
073617	87											
	88		33				4	7	5			
073624	87											
	88		14				19	15	10			
073625	87											
	88		27			10	10	7	16			1
074356	88											
	89	11	98	4	15	7	18	30	37	4	10	
014357	88											
	89	6	98		15		19	12	32			
074358	88											
	a9	19	90		21		7	17	12		7	
074609	89											
074610	89											
014611	89											

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